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THE
NUPTIAL NUMBER OF PLATO:

ITS SOLUTION AND SIGNIFICANCE.

B 858,867

BY

JAMES ADAM, M.A.,

FELLOW AND TUTOR OF EMMANUEL COLLEGE, CAMBRIDGE.

"Every divisor is a gift of God."—PLATO.

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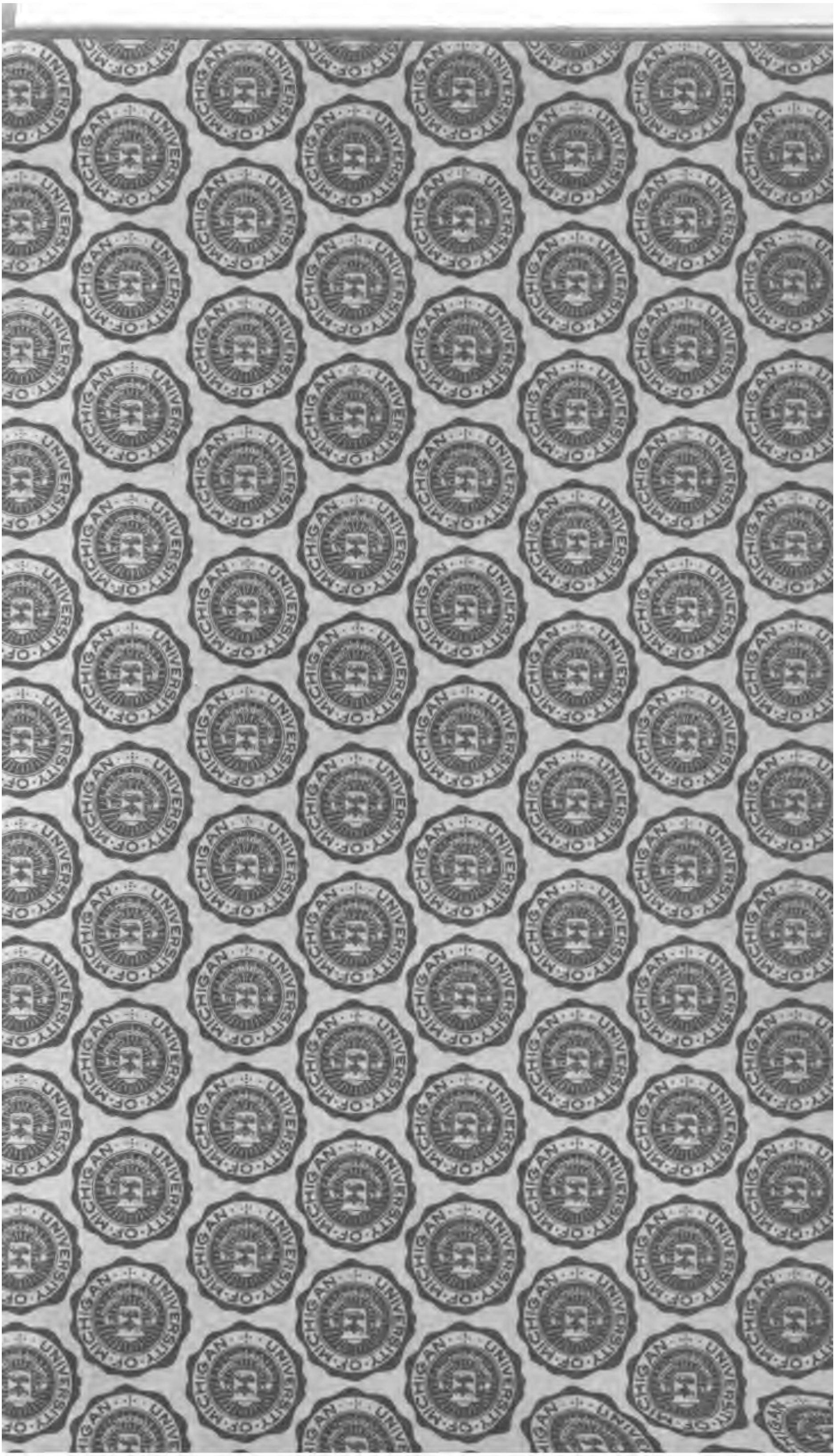

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ΦΙΛΟΠΛΑΤΩΣΙ ΦΙΛΟΠΛΑΤΩΝ.

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Who laid the corner stone thereof, when the morning stars sang together, and all the sons of God shouted for joy? Or who shut up the sea with doors, when it brake forth as if it had issued out of the womb; when I made the cloud the garment thereof, and thick darkness a swaddling band for it, and prescribed for it my decree, and set bars and doors, and said "Hitherto shalt thou come, but no further: and here shall thy proud waves be stayed?"

Job xxxviii 6—11.

The World's great age begins anew,
The golden years return,
The Earth doth like a snake renew
Her winter weeds outworn;
Heaven smiles, and faiths and empires gleam
Like wrecks of a dissolving dream.

Shelley: *Hellas.*

PREFACE.

THE present essay claims to be a complete solution of the Number of Plato.

If the results at which I have arrived are correct, the Number is not merely in itself a simple and elegant mathematical problem, but forms an organic and essential part of the argument of the Republic, and furnishes us with the right point of view from which to study the cosmology of the Timaeus. It is also full of interest for students of theology, as well as of ancient astronomy, embryology, and music.

The Muses in the Nuptial Number connect the creation of the human child with that of the divine, and measure the lifetime of the World; and the splendid harmonies of sound and style are worthy of the Muses and their theme.

I desire to thank Mr Neil of Pembroke College for reading through my proof-sheets and making various criticisms and suggestions.

EMMANUEL COLLEGE,
October 30, 1891.

THE NUPTIAL NUMBER.

> "*Propositum meum est eum Platonis in octavo de Rep. locum exponere, qui cum omnium, quae sub humanam cognitionem cadere possunt, obscurissimus sit: hactenus a nemine (quod pace omnium dicam) non modo non recte declaratus sed nequidem perceptus est: imo tritum inde proverbium apud Antiquos ortum fuit, quod nempe numeris Platonicis nihil obscurius.*"

INTRODUCTION.

THE words above quoted were written by Barocius in the preface to his attempted solution of the Nuptial Number in the year 1566. I choose them to introduce my own solution, because they are almost as true in 1891 as when Barocius wrote them. "Almost," I say, not "altogether," for the nature of the problem has been grasped (*perceptus*) by Hultsch, and to some extent by Tannery and Dupuis[1], though it has by no means been solved, as I think they will themselves allow. Human nature is prone to regard the Unsolved as the Insoluble: and so it comes to pass that while there are some who think the secret is lost for ever, others remind us that "the Muses are speaking in jest," and that "when Plato is in the mind for a mathematical joke, he is not to be taken too strictly *au pied de la lettre*." Perhaps: but to Plato mathematics were no joke, but the corner-stone of his Academy: and ἄμουσος is the man who thinks the Muses joked with difficulty.

---

[1] I wish I could say the same of Dr Gow, who has written on this subject in the *Journal of Philology* (XII pp. 91—102): but he has altogether failed to appreciate the conditions of the problem. The one phrase which he has very nearly explained is ἐπίτριτος πυθμήν: and I owe him no small gratitude for the "base four-three." Mr Monro's article in the same Journal (VIII pp. 275—289) is cautious, and puts the points well, but makes no advance on previous discussions of the subject.

If by obscurity is meant want of clearness, whether intentional or otherwise, then the reputation of the Nuptial Number for obscurity is undeserved: it is extremely difficult in its language, but not obscure. Cicero's unfortunate *numero Platonis obscurius*, by passing into a proverb, has had the most injurious effect upon the criticism of the Number. Writers have for the most part vied with one another in maintaining the credit of the proverb: it is hardly overstating the case to say that it is more difficult to master the theories of others, than to discover the truth for oneself. But Cicero is no more an oracle than Plato is oracular: and we have learnt many things about Plato that Cicero never dreamed of in his philosophy. Some of the later Greek writers understood the Number, in part, at all events, as I shall shew; and Aristotle treats it quite as an ordinary piece of mathematics[1]. Had Aristotle thought the Number obscure, does any one think he would have omitted to say so? It is not his way to let "dear Plato" off so easily. The fact that Aristotle found no difficulty should have warned all critics to look for the difficulties in the Greek, and not in the mathematics, but instead of this they have played games with numbers, prostrating themselves before their Sphinx with indiscriminate offerings of multiplication, addition, squaring, cubing, extracting the square and cube roots, till she has turned away her head in very shame, being in truth no Sphinx, but a self-respecting Muse. Where doubt is possible, I will elucidate the meaning of each word from Plato's use of the word elsewhere, except in the case of two words, for which I will cite parallels in Greek writers on mathematics. And when the arithmetic is stripped of its Greek dress, it will be seen that there is nothing in it to alarm "a gentleman and a freeman," who "may be expected to know as much arithmetic as an Egyptian child."

---

[1] "Nicht bloss dem Aristoteles sind diese Worte noch vollkommen klar, sondern auch Nikomachos, Plutarchos, Iamblichos, Proklos, und Aristeides Quintilianus sind noch nicht im mindesten zweifelhaft über ihre Bedeutung" Susemihl, *Aristoteles' Politik* II p. 370. Compare Schneider III p. ii. I have little doubt that the passage was perfectly intelligible to Aristotle and Aristides at least, and possibly to Iamblichus; but I do not think Nicomachus or Plutarch understood it fully, and Proclus, I fear, did not: see note on p. 11. Theo Smyrnaeus, in his *Expositio rerum mathematicarum ad legendum Platonem utilium*, discreetly embraces the Number from afar. Melancthon groaned over an obscurity "greater than that of the Sibyl's leaves": while Ficinus declared that nothing short of "Apollinis vaticinium" could make the Number out; and Schleiermacher (as Dupuis informs us) interrupted his translation of Plato for no less than twelve years in the vain hope of finding the right solution. The "smart and facetious Thracian maid" who scoffed at Thales when he fell into the well ὡς τὰ μὲν ἐν οὐρανῷ προθυμοῖτο εἰδέναι, τὰ δ' ἔμπροσθεν αὐτοῦ καὶ παρὰ πόδας λανθάνοι αὐτόν (Theaet. 174 A) might well have said the same of many a writer on the Nuptial Number, εἰς φρέατά τε καὶ πᾶσαν ἀπορίαν ἐμπίπτοντα (ibid. 174 C).

When reference is made to the following writers, it is, unless otherwise stated, to those of their works whose titles are here printed after their names.

Schneider (*Platonis Opera Graece,* III pp. ii—lxxxii): Monro (*Journal of Philology* VIII pp. 275—289): Gow (*Journal of Philology* XII p. 91 ff.): Hultsch (*Zeitschrift für Mathematik und Physik* XXVII, Historisch-literarische Abtheilung, pp. 41—60).

I have read besides: Donaldson in the *Proceedings of the Philological Society* Vol. I p. 81 ff.: Martin in the *Revue Archéologique* XIII p. 257 ff.: Dupuis (*Le Nombre Géométrique de Platon, Interprétation Nouvelle,* Paris 1881 and *Seconde Interprétation,* Paris 1882): Tannery in the *Revue Philosophique* I p. 170 ff., XIII p. 210 ff., XV pp. 567 ff.: Gow in the *Academy* no. 522: Demme in the *Zeitschrift für Math. und Phys.* XXXII, Historisch-literarische Abth. pp. 81—99 and 121—132: Hultsch *de numero Platonis a Proclo enarrato disputatio* in Schoell's Procli commentariorum in remp. Platonis partes ineditae[1] (1886) pp. 140—148: Jowett in *The Republic of Plato translated,* 1888, p. cxxx ff.[1]

---

[1] Not the least interesting point in connexion with the criticism of the Number is the publication for the first time in 1886 of Proclus' commentary upon the passage. It is disappointing to find that Proclus does not explain the meaning of the words, but wanders off into astrological and other vagaries: "freilich findet sich" says Hultsch "bei Proklos keine direkte Erläuterung der dunkeln und vieldeutigen Worte Platons; allein immerhin ist es ein Gewinn zu betrachten, dass die meisten der von Platon gebrauchten schwierigen Ausdrücke von dem Neuplatoniker wiederholt und in den Bereich seiner eigenen Spekulation aufgenommen worden sind." It is clear that Proclus either would not or could not explain the passage: when he commits himself to a definite view, he is for the most part demonstrably wrong.

I have refrained (except where absolutely necessary) from discussing the views of these writers, because it does not seem necessary to refute them in order to prove my own view, most of their solutions being confessedly more or less tentative. It will be my duty to discuss them when they claim to be right. To the scholarly insight of Schneider as well as to his careful collection of passages from the later Greek authors, I owe most. Monro's article first introduced me to the subject. From Gow I obtained the key to the meaning of one difficult phrase. There are valuable suggestions in several of the articles which I have read, and especially in that by Hultsch, my relation to whom will be more fully explained as we proceed.

THE TEXT, AND PLAN OF THE DISCUSSION.

For the sake of convenience I quote the passage (*Rep.* VIII 545 C—547 A) in full. I also divide the words with which we are more immediately concerned into five sections, A, B, C, D, E, to facilitate reference.

Φέρε τοίνυν, ἦν δ' ἐγώ, πειρώμεθα λέγειν, τίνα τρόπον τιμοκρατία γένοιτ' ἂν ἐξ ἀριστοκρατίας. ἢ τόδε μὲν ἁπλοῦν, ὅτι πᾶσα πολιτεία μεταβάλλει ἐξ αὐτοῦ τοῦ ἔχοντος τὰς ἀρχάς, ὅταν ἐν αὐτῷ τούτῳ στάσις ἐγγένηται· ὁμονοοῦντος δέ, κἂν πάνυ ὀλίγον ᾖ, ἀδύνατον κινηθῆναι; Ἔστι γὰρ οὕτω. Πῶς οὖν δή, εἶπον, ὦ Γλαύκων, ἡ πόλις ἡμῖν κινηθήσεται, καὶ πῇ στασιάσουσιν οἱ ἐπίκουροι καὶ οἱ ἄρχοντες πρὸς ἀλλήλους τε καὶ πρὸς ἑαυτούς; ἢ βούλει, ὥσπερ Ὅμηρος, εὐχώμεθα ταῖς Μούσαις εἰπεῖν ἡμῖν, ὅπως δὴ πρῶτον στάσις ἔμπεσε, καὶ θῶμεν[a] αὐτὰς τραγικῶς, ὡς πρὸς παῖδας ἡμᾶς παιζούσας καὶ ἐρεσχηλούσας, ὡς δὴ σπουδῇ λεγούσας ὑψηλολογουμένας λέγειν; Πῶς; Ὧδέ πως· χαλεπὸν μὲν κινηθῆναι πόλιν οὕτω ξυστᾶσαν· ἀλλ' ἐπεὶ γενομένῳ παντὶ φθορά ἐστιν, οὐδ' ἡ τοιαύτη ξύστασις τὸν ἅπαντα μενεῖ χρόνον, ἀλλὰ λυθήσεται· λύσις δὲ ἥδε. οὐ μόνον φυτοῖς ἐγγείοις, ἀλλὰ καὶ ἐν ἐπιγείοις

[a] φῶμεν MSS.

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[1] Some account of the enormous literature of the Number will be found in Schneider and in Dupuis (Interprétation Nouvelle).

*ζῴοις φορὰ καὶ ἀφορία ψυχῆς τε καὶ σωμάτων γίγνονται, ὅταν
περιτροπαὶ ἑκάστοις κύκλων περιφορὰς ξυνάπτωσι, βραχυβίοις
μὲν βραχυπόρους, ἐναντίοις δὲ ἐναντίας· γένους δὲ ὑμετέρου
εὐγονίας τε καὶ ἀφορίας, καίπερ ὄντες σοφοί, οὓς ἡγεμόνας
πόλεως ἐπαιδεύσασθε, οὐδὲν μᾶλλον λογισμῷ μετ' αἰσθήσεως
τεύξονται, ἀλλὰ πάρεισιν αὐτοὺς καὶ γεννήσουσι παῖδάς ποτε οὐ
δέον. | ἔστι δὲ θείῳ μὲν γεννητῷ περίοδος, ἣν ἀριθμὸς περιλαμβάνει* A
τέλειος, | ἀνθρωπείῳ δὲ ἐν ᾧ πρώτῳ αὐξήσεις δυνάμεναί B
*τε καὶ δυναστευόμεναι, τρεῖς ἀποστάσεις, τέτταρας δὲ ὅρους
λαβοῦσαι ὁμοιούντων τε καὶ ἀνομοιούντων καὶ αὐξόντων καὶ
φθινόντων, πάντα προσήγορα καὶ ῥητὰ πρὸς ἄλληλα ἀπέφηναν· |
ὧν ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς δύο ἁρμονίας παρέχεται* C
τρὶς αὐξηθείς, | τὴν μὲν ἴσην ἰσάκις, ἑκατὸν τοσαυτάκις, | τὴν δὲ D, E
*ἰσομήκη μὲν τῇ, προμήκη δέ, ἑκατὸν μὲν ἀριθμῶν ἀπὸ διαμέτρων
ῥητῶν πεμπάδος, δεομένων ἑνὸς ἑκάστων, ἀρρήτων δὲ δυοῖν*[b],
*ἑκατὸν δὲ κύβων τριάδος. | ξύμπας δὲ οὗτος, ἀριθμὸς γεωμετρικός,
τοιούτου κύριος, ἀμεινόνων τε καὶ χειρόνων γενέσεων, ἃς
ὅταν ἀγνοήσαντες ὑμῖν οἱ φύλακες συνοικίζωσιν νύμφας νυμφίοις
παρὰ καιρόν, οὐκ εὐφυεῖς οὐδ' εὐτυχεῖς παῖδες ἔσονται.
ὧν καταστήσονται μὲν τοὺς ἀρίστους οἱ πρότεροι, ὅμως δὲ
ὄντες ἀνάξιοι, εἰς τὰς τῶν πατέρων αὖ δυνάμεις ἐλθόντες, ἡμῶν
πρῶτον ἄρξονται ἀμελεῖν φύλακες ὄντες, παρ' ἔλαττον τοῦ
δέοντος ἡγησάμενοι τὰ μουσικῆς δεύτερον δὲ τὰ γυμναστικῆς·
ὅθεν ἀμουσότεροι γενήσονται ἡμῖν οἱ νέοι. ἐκ δὲ τούτων ἄρχοντες
οὐ πάνυ φυλακικοὶ καταστήσονται πρὸς τὸ δοκιμάζειν
τὰ Ἡσιόδου τε καὶ τὰ παρ' ὑμῖν γένη, χρυσοῦν τε καὶ ἀργυροῦν
καὶ χαλκοῦν καὶ σιδηροῦν, ὁμοῦ δὲ μιγέντος σιδηροῦ ἀργυρῷ καὶ
χαλκοῦ χρυσῷ ἀνομοιότης ἐγγενήσεται καὶ ἀνωμαλία ἀνάρμοστος,
ἃ γενόμενα, οὗ ἂν ἐγγένηται, ἀεὶ τίκτει πόλεμον καὶ ἔχθραν.
ταύτης τοι γενεᾶς χρὴ φάναι εἶναι στάσιν ὅπου ἂν γίγνηται ἀεί.*

[b] *δυεῖν* MSS.

The plan of my discussion is as follows:

Part 1. The Solution of the Nuptial Number.

Chapter I. Preliminary remarks on the Pythagorean triangle[1].

Chapter II. The words from *ἀνθρωπείῳ δὲ* to *ἑκατὸν δὲ κύβων τριάδος*.

---

[1] It will be noticed that I postpone the discussion of the *περίοδος* of the *θεῖον γεννητόν* to Part 2. The reason will appear later.

The numbers will be discovered by explaining:—(1) sections C, D, E, from *ὧν ἐπίτριτος* to *τριάδος*, the sections being taken in the reverse order, viz.: E, D, C: (2) section B, from *ἀνθρωπείῳ δὲ* to *ἀπέφηναν*.

Part 2. The Significance of the Nuptial Number.

Chapter I. The translation.

Chapter II. The significance of the Numbers both of the "Divine and Human Creatures."

PART 1.

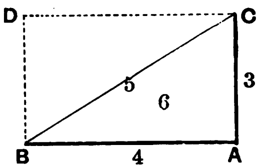
THE SOLUTION OF THE NUPTIAL NUMBER.

CHAPTER I.

THE PYTHAGOREAN TRIANGLE.

It is no part of my purpose to give an account of the Pythagorean triangle[1]—the right-angled triangle, whose sides are 3 and 4, whose hypotenuse is consequently[2] 5, and whose area is $\frac{4 \times 3}{2} = 6$ (see Fig. i)[3]. But it is necessary to mention the evidence which there is for believing that Plato made use of this triangle in his Nuptial Number.

Fig. i.



I will afterwards shew how Aristotle himself implies beyond dispute that the Pythagorean triangle was the basis of the number in the section which I have called B. Besides Aristotle we have the testimony of at least three authors (cited by Schneider[4]), viz. Plutarch (*de Is. et Os.* p. 373 F), where he says *τῶν τριγώνων τὸ κάλλιστον—ᾧ καὶ Πλάτων ἐν τῇ πολιτείᾳ δοκεῖ προσκεχρῆσθαι, τὸ γαμήλιον διάγραμμα συντάττων. ἔχει δὲ ἐκεῖνο τὸ τρίγωνον τριῶν τὴν πρὸς ὀρθάς, καὶ τεττάρων τὴν βάσιν καὶ πέντε τὴν ὑποτείνουσαν*

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[1] See Gow *History of Greek Mathematics*, p. 155.

[2] By Euclid I 47—a proposition which is said to have been discovered by Pythagoras, and which was certainly familiar to Plato: see *Tim.* 54 B.

[3] *ABC*, the right-angled triangle in which $AC=3$, and $AB=4$, is half the rectangle *ABDC*, i.e. it is $\frac{4 \times 3}{2}=6$.

[4] p. xxxii. Compare also Iamblichus, *Vit. Pythag.* § 131.

ἴσον ταῖς περιεχούσαις δυναμένην: Proclus (*in Euclid.* p. 428, Teubner edition) in these words: *τὸ ἐν πολιτείᾳ τρίγωνον, οὗ τὴν ὀρθὴν περιέχουσιν ὅ τε τρία* (sc. *ἀριθμός*) *καὶ ὁ τέσσαρα*: and Aristides Quintilianus, who (*De Musica*, ed. Meibom, p. 152) remarks: *αἱ δὲ τὴν ὀρθὴν περιέχουσαι δηλοῦσι τὸν ἐπίτριτον. τούτου δὴ καὶ Πλάτων φησὶν ἐπίτριτον πυθμένα πεμπάδι συζυγέντα.* We are therefore prepared to meet with the Pythagorean triangle—in whole and in part—its area and its sides—throughout the Nuptial Number.

CHAPTER II.

THE WORDS FROM *ἀνθρωπείῳ δέ* TO *ἑκατὸν δὲ κύβων τριάδος*.

According to my plan, I will discover the numbers by explaining (1) E, D, C, and (2) B. We begin with E, viz. the words *τὴν δὲ ἰσομήκη μὲν τῇ, προμήκη δέ, ἑκατὸν μὲν ἀριθμῶν ἀπὸ διαμέτρων ῥητῶν πεμπάδος, δεομένων ἑνὸς ἑκάστων, ἀρρήτων δὲ δυοῖν, ἑκατὸν δὲ κύβων τριάδος.*

I will work backwards, beginning with the clause *ἑκατὸν δὲ κύβων τριάδος.*

These words mean "of, on the other hand, one hundred cubes of three" $= 100 \times 3^3 = 2700$.

Next comes the clause: *ἑκατὸν μὲν ἀριθμῶν ἀπὸ διαμέτρων ῥητῶν πεμπάδος, δεομένων ἑνὸς ἑκάστων, ἀρρήτων δὲ δυοῖν.*

"Hoc loco," says Schneider[1], "maxima gratia debetur Barocio, qui primus verborum obscurissimorum sensum perspexit et aperuit......Quamquam ne ipse quidem portum cepit, quum in aliis partibus offendisset, hunc quidem scopulum superavit felicissime." There is no doubt whatever about the meaning, and the interpretation which I shall give is accepted by every scholarly critic with the single and most unfortunate exception of Hultsch[2].

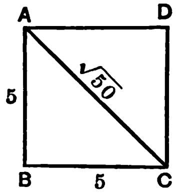
---

[1] p. xxv. Schneider (pp. iii—xviii) gives a very full account of Barocius' tract, which is now exceedingly rare. There is a copy of it in the British Museum. The Italian form of Barocius' name is Barozzi.

[2] p. 48. Hultsch assigns no reason for rejecting the usual interpretation of these words. If he had only interpreted this part rightly, I think it not unlikely that he would have solved the number: as it is, his article is a striking confirmation of the old proverb *ἀρχὴ δέ τε ἥμισυ παντός.* See p. 39.

The "rational diameter of five" is the nearest rational number to the real diameter of a square whose side is five[1], i.e. to $\sqrt{50}$ by Euclid I 47 (see Fig. ii). Now the nearest rational number to $\sqrt{50}$ is $7 = \sqrt{49}$. Therefore *ῥηταὶ διάμετροι πεμπάδος* means simply "sevens."

Fig. ii.



ἀριθμοὶ ἀπό means "numbers representing the area of squares constructed upon" (*ἀπό* = "from," sc. as a base), or in geometrical language "squares of." This use of *ἀπό* is regular among Greek mathematical writers[2], and is also found in Plato, e.g. *Meno* 85 B *ἀπὸ τῆς διαμέτρου ἄν, ὡς σὺ φῄς, ὦ παῖ Μένωνος, γίγνοιτ' ἂν τὸ διπλάσιον χωρίον.*

The words *ἑκατὸν μὲν ἀριθμῶν ἀπὸ διαμέτρων ῥητῶν πεμπάδος* therefore mean[3] "of, on the one hand, one hundred squares of sevens," i.e. $100 \times 7^2 = 4900$.

It remains to explain *δεομένων ἑνὸς ἑκάστων*, and *ἀρρήτων δὲ δυοῖν.*

The first means simply "each *ἀριθμός* or square wanting 1," i.e. minus 1. The logical expression would be *δεομένου ἑνὸς*

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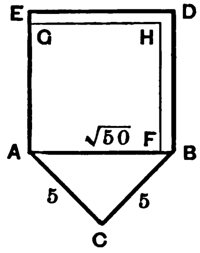
[1] The evidence for this is Theo Smyrnaeus, p. 43 ff. Cf. Gow, *Gk. Math.* p. 96. This is (I think) the only passage in Plato where "rational diameters" are mentioned. In *Theaetetus* 147 D ff. he merely distinguishes rational from irrational *roots* or surds: while a careful study of *Polit.* 266 A—B shews that the passage is in no way parallel to ours except in the use of *διάμετρος*. But there is nothing harsh or difficult, from the Greek point of view, in the expression "rational diameter." The geometrical construction is very simple. Let $AB = \sqrt{50}$, i.e. the *irrational* diameter of 5, and consequently $ABDE$ = the square of (ἀπὸ) $AB = 50$, we have only to insert in $ABDE$ the largest square of a rational number which it will contain, say $AFHG$, and AF will be the *rational* diameter of 5, i.e. *that part of the diameter of* 5 *which is rational.*



[2] See Euclid, *passim.*

[3] It may be asked, Why did not Plato simply say "of 4900," and above "of 2700"? Why express himself in this apparently cumbrous fashion? In order, of course, to express the numbers in terms of sides of the Pythagorean triangle, 5 and 3. The number 100 is also significant, as we shall see. Compare p. 71.

ἑκάστου, but this would be cumbrous and obscure, and Plato is neither. He therefore writes as he would speak, *δεομένων ἑνὸς ἑκάστων*, letting *ἑκάστου* assimilate itself to *ἀριθμῶν*.

We can now interpret the whole expression *ἑκατὸν μὲν ἀριθμῶν ἀπὸ διαμέτρων ῥητῶν πεμπάδος, δεομένων ἑνὸς ἑκάστων.* It is equivalent to $(7^2 \times 100) - (1 \times 100) = 4900 - 100 = 4800$.

ἀρρήτων δὲ δυοῖν is superfluous—the number could be made out if—*ἐς τὸ πᾶν ἐτητύμως*—the two words had been left unspoken. They merely give another way of arriving at 4800. The translation is: "or, if you take *irrational* diameters of 5, wanting 2 each." The construction is <*ἀπὸ*> *ἀρρήτων δὲ* <*διαμέτρων δεομένων*> *δυοῖν* <*ἑκάστων*>. The meaning, expressed in figures, is simply this: "or, if you prefer it, of $(\sqrt{50})^2 \times 100 - (2 \times 100) = 5000 - 200 = 4800$." Those who know ancient Greek as a living language will read the sentence out aloud, laying the proper emphasis on *ἑκατόν*, *ῥητῶν*, *ἑνός*, *ἀρρήτων*, *δυοῖν*, and pronouncing the words *ἀρρήτων* and *δυοῖν* slowly and distinctly, and the meaning will at once appear. *δέ* gives an alternative, as in *μᾶλλον δέ* = vel potius. Plato inserted the words *ἀρρήτων δὲ δυοῖν* for the benefit of those who might be puzzled by the somewhat technical, and, in his day, perhaps novel expression, "rational diameter": so little did he wish to be obscure.

So far we have reached[1] two numbers, viz. 4800 and 2700. It remains to see what use is to be made of them. That they stand to one another in some kind of contrasting relation is clear from the *μέν* and *δέ* in *ἑκατὸν μέν* and *ἑκατὸν δέ*. The words *τὴν δὲ ἰσομήκη μὲν τῇ, προμήκη δέ* make clear the nature of the relation. They denote, as Hultsch[2] has seen, a rectangle—the figure which is "in one direction equal in its lengths, while in another it is not." "This rectangle" (says Plato, literally translated) is, "on the one side, of 4800, on the other, of 2700," i.e. its adjacent sides are 4800 and 2700. The area is therefore

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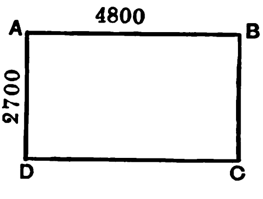
[1] Proclus understood that these two numbers were 4800 and 2700, as appears from Schoell's *Procli partes ineditae* p. 25, 21 ff. But he wanders far astray very soon, and does not try to explain how the two numbers can be got out of Plato's words.

[2] p. 46. Hultsch changes *τῇ* into *πη* (*sic*), wrongly, I think, for *πη* is not sufficiently precise. The somewhat unusual order throws emphasis on *τῇ*, and serves to bring *ἰσομήκη* and *προμήκη* into sharp contrast The sense would be complete if Plato had written only *τὴν δὲ προμήκη*, but *ἰσομήκη μὲν τῇ* connects the rectangle closely with the square, which it is worth while to do, because their areas, as we shall see, are the same.

$$4800 \times 2700 = 12{,}960{,}000$$

(see Fig. iii).

Fig. iii.



One question remains, viz., why is the rectangle called a *ἁρμονία*? Fully to answer this now would lead me into the part of my discussion dealing with the Significance of the Number. But the mathematical meaning may well be explained at the present stage. The rectangle is a *ἁρμονία* because the two sides, which enclose and make it, are derived by Plato from a certain ratio by means of an *ἰσότης γεωμετρική*—the kind of *ἰσότης* which *καὶ ἐν θεοῖς καὶ ἐν ἀνθρώποις μέγα δύναται*[1]. Thus: the two sides are 4800 and 2700, and Plato derives them from the ratio 48 : 27, by means of the *ἰσότης γεωμετρική* 4800 : 2700 = 48 : 27, in other words, by multiplying both terms of the ratio 48 : 27 by 100.

Armed with the number which we have just wrested from E, we next proceed to encounter D viz. the words *τὴν μὲν ἴσην ἰσάκις, ἑκατὸν τοσαυτάκις*. But it is necessary, as a preliminary step, to interpret the word *παρέχεται*. Let us for brevity call the subject of *παρέχεται* the number x, then "x provides us with two *ἁρμονίαι*" may mean "the number x may be made to assume either of two shapes, each of which is a *ἁρμονία*." Of course *παρέχεται* may also mean x furnishes us with two *ἁρμονίαι*, of which it is itself the sum[2]: which of these two meanings it bears here, *αὐτὸ δείξει*.

We will assume till we are undeceived that *παρέχεται* bears the former meaning[1]. *One* of the two shapes which x assumes we have seen to be a rectangle of 2700 × 4800, and thus we have discovered the value of x to be $(2700 \times 4800) = 12{,}960{,}000$. We have therefore to see whether this number will assume the shape of a second *ἁρμονία*, described in the words *τὴν μὲν ἴσην ἰσάκις, ἑκατὸν τοσαυτάκις*.

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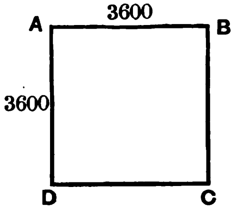
[1] *Gorg.* 508 A, where see Thompson's note. $a : b :: c : d$ and $a : b :: b : c$ are both examples of *γεωμετρικὴ ἰσότης*: the former Aristotle calls *ἀναλογία διῃρημένη*, the latter *ἀναλογία συνεχής*. See *Eth. Nic.* v 6. 1131^a 31 ff. and cf. Nicom. *Inst. Arithm.* II p. 141 ch. 24 (Ast).

[2] I think the use of the middle is somewhat against this view: cf. *Phaed.* 110 C.

ἴση ἰσάκις can only mean a square, as (I think) every writer except Gow[2] admits. The expression is a regular one in Plato: compare *Theaet.* 147 E *τὸν μὲν δυνάμενον ἴσον ἰσάκις γίγνεσθαι τῷ τετραγώνῳ τὸ σχῆμα ἀπεικάσαντες τετράγωνόν τε καὶ ἰσόπλευρον προσείπομεν*: i.e. the number which is able to be made equal an equal number of times is a square, e.g. 36, which can be made 6 six times. The words *ἑκατὸν τοσαυτάκις* mean literally "so many times 100": this harmony is therefore a number which can be made "equal an equal number of times, viz. *so many times*" (i.e. a certain number of times[3]) "100." But how many times 100? Call the number of times x, and the harmony may be expressed as $100x \times 100x$, i.e. $(100 \times x)^2$, exactly as $36 = 6 \times 6$.

Will then 12,960,000 assume the form of "$(100 \times x)^2$"? It resolves itself at once into $(100 \times 36)^2$, i.e. 3600^2 (Fig. iv).

FIG. iv.



As in the case of the rectangle 2700 × 4800, so here, I must postpone my final answer to the question, "Why is 3600^2 a *ἁρμονία*?" For the present it is enough to note that when Plato says that the sides of the square are each "*one hundred* multiplied by x," he is deriving them from the ratio $x : x$ by means of the *γεωμετρικὴ ἰσότης* $100x : 100x = x : x$, in other words, by multiplying each term of the ratio $x : x$ by 100. The parallel with the rectangle is thus complete: in the one the *ἰσότης γεω-*

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[1] So also Hultsch, p. 46. Cf. *infra*, p. 40.

[2] p. 94. Gow actually thinks that the words can denote a cube.

[3] With this use of *τοσαυτάκις* cf. Phaedrus 271 D *ἀνάγκη εἰδέναι ψυχὴ ὅσα εἴδη ἔχει. ἔστιν οὖν τόσα καὶ τόσα καὶ τοῖα καὶ τοῖα* and Laws IV 721 D *ζημιούσθω μὲν κατ' ἐνιαυτὸν τόσῳ καὶ τόσῳ*. The antecedent is in reality the unknown quantity.

μετρική involved is 4800 : 2700 :: 48 : 27; in the other, since $x = 36$, it is 3600 : 3600 :: 36 : 36.

E and D have yielded us their secret and we rise to C—the words *ὧν ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς δύο ἁρμονίας παρέχεται τρὶς αὐξηθείς*. These words are somewhat more difficult than anything in D or E, but they can be interpreted with absolute certainty. Let x (as before) represent the whole subject of *παρέχεται*: Plato says that x *παρέχεται δύο ἁρμονίας*. Now we have found that x is 12,960,000: and the whole subject of *παρέχεται* is *ὧν ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς τρὶς αὐξηθείς*: these words therefore must mean 12,960,000. Let us take them singly. *ὧν* = "of which" has for its antecedent the word *αὐξήσεις* in B. In order not to anticipate my interpretation of the *words* in B, I will ask the reader to believe now, what I shall prove afterwards (p. 33 ff.), that the process denoted by *αὐξήσεις* gives us the elements which make up the number contained in section B, and that we may therefore, for practical purposes, regard that number as the antecedent of *ὧν*. It is therefore necessary to discover that number before we can interpret *ὧν*. For the reason which I have stated, and also for another which will presently appear, I will not now wring the secret out of Plato's words, but from Aristotle.

In the *Politics* (v 12. 1316^a) Aristotle criticises Plato's account of the transition from the best to the second-best *πολιτεία* in these words—*ἐν δὲ τῇ πολιτείᾳ λέγεται μὲν περὶ τῶν μεταβολῶν ὑπὸ τοῦ Σωκράτους, οὐ μέντοι λέγεται καλῶς· τῆς τε γὰρ ἀρίστης πολιτείας καὶ πρώτης οὔσης οὐ λέγει τὴν μεταβολὴν ἰδίως. φησὶ γὰρ αἴτιον εἶναι τὸ μὴ μένειν μηθὲν ἀλλ' ἔν τινι περιόδῳ μεταβάλλειν, ἀρχὴν δ' εἶναι τούτων ὧν ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς δύο ἁρμονίας παρέχεται, λέγων ὅταν ὁ τοῦ διαγράμματος ἀριθμὸς τούτου γένηται στερεός, ὡς τῆς φύσεώς ποτε φυούσης φαύλους καὶ κρείττους τῆς παιδείας. τοῦτο μὲν οὖν αὐτὸ λέγων ἴσως οὐ κακῶς· ἐνδέχεται γὰρ εἶναί τινας οὓς παιδευθῆναι καὶ γενέσθαι σπουδαίους ἄνδρας ἀδύνατον. ἀλλ' αὕτη τί ἂν ἴδιος εἴη μεταβολὴ τῆς ὑπ' ἐκείνου λεγομένης ἀρίστης πολιτείας μᾶλλον ἢ τῶν ἄλλων πασῶν καὶ τῶν γιγνομένων πάντων;* This is not the place to discuss the relevancy of Aristotle's criticism as a whole: I will only remark, for the sake of those who think Plato is only fooling, that Aristotle not only takes him seriously, but admits that the number of Plato actually does give a correct reason for the change of constitutions in general. Plato, he says, ought to have given the specific reason for the change from the best to the second-best constitution in particular. This will help us to discover, when we come to Part 2, what facts or supposed facts in life Plato meant his number to represent.

Meantime the words that concern us now are those which I have printed in spaced type, viz. from *φησὶ γὰρ* to *γένηται στερεός*. They have been grievously misunderstood by Monro and Gow, who think they refer, not to the section which I call B, but to the subsequent sections. Gow, indeed, seems to have felt prickings of heart when he wrote the following: "The word *ὧν* seems to me hardly capable of translation in Aristotle and is retained only to identify the quotation. In Plato of course it is very important[1]." The correct translation is this: "for he says the fact that nothing abides but everything changes within a certain period, is the cause" (sc. of change from Aristocracy to the Laconic state), "while the beginning (sc. of change) "is of[2]" (i.e. belongs to, comes from) "those things" (i.e. the *αὐξήσεις*), "the 4 : 3 base of which, yoked with 5, furnishes two harmonies—meaning, *when the number of this diagram is made solid*." That is, the beginning of change is the number which is virtually the antecedent of *ὧν*, and that number is the number which you obtain by making the "number of this diagram solid." Now what is "*this*" diagram? The antecedent of *τούτου* is *ἐπίτριτος πυθμήν*: and *ἐπίτριτος πυθμήν* is the ratio 4 : 3, considered as a base of something—in this case of the number contained in B. Virtually, therefore, Aristotle calls *ἐπίτριτος* (*πυθμήν*) a diagram. Put *ἐπίτριτος* in the form of a diagram. Let $AC = 4$ and $AB = 3$ be at right angles

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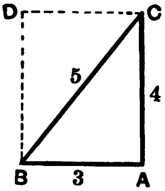
[1] p. 93, note 1.

[2] I first explained the words *ἀρχὴν δ' εἶναι τούτων ὧν* as $=$ *ἀρχὴν δ' εἶναι τούτων* (sc. change, or the influences which make for change) <*ταῦτα*> *ὧν* (i.e. those things, viz. the *αὐξήσεις* of which &c.). On looking at Schneider, who alone of the writers whom I have read, interprets Aristotle aright, I found that he definitely rejected the construction which I thought right. The meaning is the same in either case; but though I now agree with Schneider, I think it worth while to state my earlier view, in case it should better satisfy the ear of some readers.

FIG. V.



to one another: join BC and your diagram is complete. Then $BC^2 = 3^2 + 4^2 = 9 + 16 = 25$; $\therefore$ $BC = 5$. *τὸ τοῦ Πυθαγόρου εὕρηκα.* It is pleasing to welcome his triangle again. The area or number of this triangle, as we have seen, is 6; make it solid, as Aristotle bids us, i.e. cube it, and $6^3 = 216$. I have thus shewn from Aristotle, without making any use of Plato, that the number contained in B is $6^3 = 216$.

At last we are in a position to interpret *ὧν*. The word means "of 6^3." Now $6^3 = 3^3 + 4^3 + 5^3$, and we shall presently see that Plato himself expresses the number of B as the sum of the cubes of three numbers. What then is the *ἐπίτριτος πυθμήν* of $3^3 + 4^3 + 5^3$? I quote from Gow[1], who has come very near to the true explanation of this phrase.

"The most common mathematical use of *πυθμήν* is in the sense of 'type,' 'simplest form,' 'lowest terms,' or something analogous to these. Thus, according to Theon (*De Musica*, c. 29, p. 80, of Hiller's ed.), the ratio 3 : 4 is the *πυθμήν* of the ratio 6 : 8, 12 : 16, etc. Similarly, Apollonius of Perga, for the purpose of his new system of multiplication which Pappus (Bk II) describes, used to call 7 the *πυθμήν* of 70, 700, 7000, etc., and 5 of 50, 500, 5000, etc. (cf. *πυθμενεῖν, πυθμενικῶς*)." The words of Theo are (l. c., p. 81) *ἡμιολίων μὲν λόγων πρῶτος καὶ πυθμὴν ὁ τῶν γ′ πρὸς τὰ β′, ἐπιτρίτων δὲ, ὁ τῶν δ′ πρὸς γ′, καὶ ἐπιτετάρτων ὁ τῶν ε′ πρὸς δ′.* We may reasonably infer that the *πυθμήν* of $3^3 + 4^3 + 5^3$ is $3 + 4 + 5$, which $= 12$. It is called *ἐπίτριτος* because two of its terms are 4 and 3: it is really *ἐπίτριτος καὶ ἐπιτέταρτος*, but it is not necessary to add "*καὶ* ἐπιτέταρτος," because, if you have the sides 4 and 3 of a right-angled triangle given, the hypotenuse can be found by extracting the square root of the sum of their squares: Plato still has the Pythagorean triangle in his mind. It is worthy of notice by those who think Plato meant to be obscure that he should have further defined πυθμήν by ἐπίτριτος, when πυθμήν by itself would have expressed his meaning fully.

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[1] p. 96.

Therefore ὧν ἐπίτριτος πυθμήν = 12. πεμπάδι συζυγείς is "yoked with five," i.e. multiplied by five. In συζυγείς there is a hint of what I may call the matrimonial metaphor, not inappropriate in a Nuptial Number. The union of 12 with 5 produces 60.

A few minutes more, and the problem will be solved. 60 τρὶς αὐξηθείς means 60 *raised to the fourth power*. This is perhaps a shock—the first, I hope—but I can prove it, to the hilt[1].

First, let us clear the ground. By every writer whom I have read, the words are taken as meaning cubed, or else the multiplication of some three factors: Weber, however, as I learn from Monro[2], saw this much—that the words denote three separate processes of multiplication. I will take Monro and Gow as types. The former observes[3]: "The phrase τρὶς αὐξηθείς may be translated 'raised to the third dimension,' since it may imply either 'solid' numbers (products of three factors) in general, or the cube, which is the solid number *par excellence*. For the former use, see *Rep.* 528 B; for the latter, *Rep.* 587 D. Aristotle (l. c.) paraphrases τρὶς αὐξηθείς by the words ὅταν ὁ τοῦ διαγράμματος ἀριθμὸς τούτου γένηται στερεός." In Gow's article[4] we read: "στερεός" (sc. in the passage quoted from Aristotle above) "seems to be equivalent to and explanatory of τρὶς αὐξηθείς (cf. Plato, *Rep.* VII 528 B)." That is, they would regard 60 τρὶς αὐξηθείς as equivalent to 60^3, not 60^4. (I say "*would* regard," because Gow *does* take τρὶς αὐξηθείς as meaning merely the multiplication of *three* numbers, which in this case, he thinks, are different from one another (viz. 15, 20, 25), but Monro admits[1], and Gow would not deny, that the three factors *may be* identical. The fact is *αὐξηθείς* means simply "multiplied": if the multiplier is not stated, it means "multiplied by itself"; otherwise the multiplier must be expressed.)

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[1] It is not, of course, necessary to suppose that Plato conceived of a fourth dimension: for 60^4 may be represented by a solid figure which is 3600 × 60 × 60.

[2] p. 284.

[3] p. 280.

[4] p. 93.

In support of their explanation they quote, in the first place, the words of Aristotle (*ὅταν ὁ τοῦ διαγράμματος ἀριθμὸς τούτου γένηται στερεός*), but I have already shewn that these words were never intended to explain *τρὶς αὐξηθείς*—*τρὶς αὐξηθείς* Aristotle does not so much as quote: they were intended to explain the number in the section which I have called B.

In the second place, they refer to Plato, *Republic* VII 528 B and 587 D. I cite these two passages in full. The first is as follows: *μετὰ ἐπίπεδον, ἦν δ' ἐγώ, ἐν περιφορᾷ ὂν ἤδη στερεὸν λαβόντες, πρὶν αὐτὸ καθ' αὐτὸ λαβεῖν· ὀρθῶς δὲ ἔχει ἑξῆς μετὰ δευτέραν αὔξην τρίτην λαμβάνειν. ἔστι δέ που τοῦτο περὶ τὴν τῶν κύβων αὔξην καὶ τὸ βάθους μετέχον* (528 B). The second runs thus: *κατὰ δὲ δύναμιν καὶ τρίτην αὔξην δῆλον δὴ ἀπόστασιν ὅσην ἀφεστηκὼς γίγνεται* (587 D).

The first passage occurs where Plato says that the study of solids by themselves should precede the study of solids *ἐν περιφορᾷ*, i.e. astronomy: after the second "increase," says Plato, we ought to take the third. Let us see what this means. A point (= unity) has *no* "increase": a line (say 3) has one: a rectangle (say 3 × 4) has two (*δευτέρα αὔξη*): a solid figure (say 3 × 4 × 5) has three. A solid figure is therefore rightly said to be or have *τρίτη αὔξη*, because your reckoning begins from the point, which has *no* dimension. Heaven forbid that I should deny this! The second passage deals with a case, not of solids in general, but of cubes. The number in question is 9—which is (says Plato) the measure of the distance separating the tyrant from true pleasure: "and how far removed the tyrant is *according to the square and the third increase*, is manifest." But the third increase of what? Certainly not of 9 (though *belonging* to 9), for 9 is itself already *one* increase, viz. of unity—but the third increase of unity in that special case where 9 is its first increase. The phrase *τρίτη αὔξη* (sc. of unity) has already become a stereotyped phrase for third dimension—third, i.e. reckoning from the unit or point.

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[1] p. 280.

Second: we may arrive at the right meaning by a study of the word *αὔξησις*. Aristotle[1] distinguishes *γένεσις* from *αὔξησις* in these words: *φανερὸν δὴ—ὅτι οὐκ ἔστιν ἡ αὔξησις μεταβολὴ ἐκ δυνάμει μεγέθους, ἐντελεχείᾳ δὲ μηδὲν ἔχοντος μέγεθος...ἔτι δὲ ἥ γε τοιαύτη μεταβολὴ οὐκ αὐξήσεως ἴδιος ἀλλὰ γενέσεως· ἡ γὰρ αὔξησίς ἐστι τοῦ ἐνυπάρχοντος μεγέθους ἐπίδοσις, ἡ δὲ φθίσις μείωσις.* Compare with this another passage of the same treatise[2]: *ἐν μὲν γὰρ τῷ γίγνεσθαί τι ἁπλῶς ἢ φθείρεσθαι οὐχ ὑπομένει, ἐν δὲ τῷ ἀλλοιοῦσθαι ἢ αὐξάνεσθαι ἢ φθίνειν ὑπομένει τὸ αὐτὸ τὸ αὐξανόμενον ἢ ἀλλοιούμενον· ἀλλ᾽ ἔνθα μὲν τὸ πάθος, ἔνθα δὲ τὸ μέγεθος τὸ αὐτὸ οὐ μένει.* In other words, the process which calls a thing into being out of nothing is *ἁπλῆ γένεσις*, not *αὔξησις*: in *αὔξησις* the original size is not lost, but increased. Now apply this to the number 60. Increased once, what does it become? Certainly not 60, which it already is: else what of the words *τοῦ ἐνυπάρχοντος ἐπίδοσις*, and *ὑπομένει τὸ αὐτὸ τὸ αὐξανόμενον,...ἔνθα δὲ τὸ μέγεθος τὸ αὐτὸ οὐ μένει*? Does the process of *αὔξησις*, when applied to a number, scare it away first, and afterwards tempt it back again? Credat Judaeus Apella. 60 once "increased" (i.e. according to the Greek idiom[3], multiplied by itself), is 60^2; twice "increased" it is 60^3; thrice "increased" it is 60^4. Apply the reverse process to 60^3, and the absurdity of the usual interpretation will at once appear. If 60^3 is 60 *three* times "increased," then 60^2 is 60 *twice* "increased," 60 is 60 *once* increased, and nothing—or rather, unity, which is the point[4],—is 60. Shylock will "make money for others and not for himself" if he even takes "doit of usance" by this scale:

> "Give me my principal and let me go;
> I pray you give me leave to go from hence;
> I am not well."

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[1] *De Gen. et Corr.* A 5. 320^b 25 ff.

[2] *ib.* 321^a 22 ff.

[3] *supra*, p. 26.

[4] The Greeks did not regard 'nought' as a number and had no symbol for it: Cantor, *Vorlesungen zur Gesch. der Mathem.* p. 144.

When Aristotle says, in the passage above cited, *ὅταν ὁ τοῦ διαγράμματος ἀριθμὸς τούτου γένηται στερεός* he means that 6, which has already one dimension, by getting *two* more becomes 216. The number 216 we may then call either an *ἀριθμὸς τρὶς ηὐξημένος*, i.e. a number which is thrice increased (sc. from unity, by means of 6), or we may call it *ὁ ἓξ ἀριθμὸς δὶς ηὐξημένος*, because *ἓξ δὶς αὐξηθείς* produces it.

Third: I think I have fully proved my point, but as this is the keystone of the whole fabric of the Nuptial Number I make no apology for presenting the drift of my argument in a tabulated form:

I. *αὔξησις* of unity
1. unity
2. 60 = unity once multiplied by 60
3. 60^2 = unity twice multiplied by 60
4. 60^3 = unity thrice multiplied by 60

II. *αὔξησις* of 60
1. 60
2. 60^2 = 60 once multiplied by 60
3. 60^3 = 60 twice multiplied by 60
4. 60^4 = 60 thrice multiplied by 60

The words *ὧν ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς τρὶς αὐξηθείς* accordingly mean 60^4,

$$\text{i.e. } 60 \times 60 \times 60 \times 60 = 12{,}960{,}000,$$

which can be, as we have seen, resolved into two harmonies, viz. 3600^2 and 4800 × 2700.

(2) *The Number of* B.

The first rampart has now been carried, and we may pause to collect our forces before we assault the second. We have shewn that Aristotle explained the number of B as the cube of the area of the Pythagorean triangle, viz. $6^3 = 216$. We have shewn that *ἐπίτριτος πυθμήν* is $3 + 4 + 5$, which is the sum of the sides of the Pythagorean triangle. It remains to shew that the processes described by the words of B give us the number 216, expressed in terms of the Pythagorean triangle.

So far as I can discover, except as regards the words *δυνάμεναί τε καὶ δυναστευόμεναι*, which have been partially explained before, my explanation of this section of the Number is altogether new. But I should not be surprised if it were some day found among the writings of the Neoplatonists or Neopythagoreans. Every word can be interpreted out of Plato's own mouth, with the sole exception of *δυναστευόμεναι*, which is fully explained by Proclus: and I am far from thinking that the Neoplatonists, who spoke the language of Plato, and taught his doctrine, blended indeed with much that is new and strange, were all of them baffled by what is after all no more than an extremely difficult piece of Greek. The words are:

> *ἀνθρωπείῳ δὲ ἐν ᾧ πρώτῳ αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι, τρεῖς ἀποστάσεις, τέτταρας δὲ ὅρους λαβοῦσαι ὁμοιούντων τε καὶ ἀνομοιούντων καὶ αὐξόντων καὶ φθινόντων, πάντα προσήγορα καὶ ῥητὰ πρὸς ἄλληλα ἀπέφηναν.*

I will take the words in the order in which they occur.

The construction of *ἀνθρωπείῳ δὲ ἐν ᾧ πρώτῳ* is *ἀνθρωπείῳ δὲ <γεννητῷ ἔστιν ἀριθμὸς> ἐν ᾧ πρώτῳ*, which is itself an abbreviated expression for *ἀνθρωπείῳ δὲ <γεννητῷ ἔστι περίοδος ἣν ἀριθμὸς περιλαμβάνει> ἐν ᾧ πρώτῳ*. The words mean this: "while the number of an *ἀνθρώπειον γεννητόν* is the first number in which." I cannot, without anticipating the results of Part 2, fully explain the meaning of the word *πρώτῳ*: it will suffice at present to say that it means "the first number," i.e. "the first number after unity," which fulfils the conditions herein described.

I will now explain the words *αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι*. It will be allowed, after the discussion on p. 25, that *αὐξήσεις* means "multiplications." But of what factors? I will shew that the factors are explained by the words *δυνάμεναί τε καὶ δυναστευόμεναι*.

First let me take the word *δυνάμεναι*. It is clear from more than one passage in Plato that the mathematical sense of *δύνασθαι* "be equal when squared to" i.e. "be the square root of" was not in his day fully developed. In *Theaetetus* 147 E—*τὸν ἀριθμὸν πάντα δίχα διελάβομεν· τὸν μὲν δυνά-*

μενον ἴσον ἰσάκις γίγνεσθαι τῷ τετραγώνῳ τὸ σχῆμα ἀπεικάσαντες τετράγωνόν τε καὶ ἰσόπλευρον προσείπομεν—it is a *square* number which is said to be *δυνάμενος* (viz. *ἴσος ἰσάκις γίγνεσθαι*), while in 148 B—*ὅσαι μὲν γραμμαὶ τὸν ἰσόπλευρον καὶ ἐπίπεδον ἀριθμὸν τετραγωνίζουσι, μῆκος ὡρισάμεθα, ὅσαι δὲ τὸν ἑτερομήκη, δυνάμεις*[1], *ὡς μήκει μὲν οὐ ξυμμέτρους ἐκείνοις, τοῖς δ' ἐπιπέδοις ἃ δύνανται*—it is the *roots* which are *δυνάμενα* (sc. to produce squares), as in Euclid X Def. 11 *καὶ αἱ δυνάμεναι αὐτὰ ἄλογοι.* But on comparing these two passages from Plato, we note that, while *δυνάμενον* is *not* used absolutely in the sense of a square, but requires to be explained by the words *ἴσος ἰσάκις γίγνεσθαι*, *δύνανται*, where it *is* used absolutely, means "are the roots of." We infer that *δυνάμεναι* in our passage refers to roots and not to squares. Our inference will be confirmed as we proceed.

Next I will explain the word *δυναστευόμεναι.* It is fortunate that Proclus[2] should have expressly alluded to this part of Plato's Number. At the outset of his commentary on the first book of Euclid he endeavours to shew that the *ἀρχαί* of the Universe of things—*τῶν ὄντων ἁπάντων*—are also the *ἀρχαί* of Mathematics. One of his examples, that from *δυνάμεις*, is as follows[3]: *καὶ ὅσα κατὰ τὰς δυνάμεις ἀναφαίνεται πᾶσιν ὁμοίως προσήκει τοῖς μαθήμασι, τῶν μὲν δυναμένων, τῶν δὲ δυναστευομένων. ἃ δὴ καὶ ὁ ἐν πολιτείᾳ Σωκράτης ταῖς μούσαις ὑψηλολογουμέναις ἀνέθηκεν, τὰ κοινὰ πάντων τῶν μαθηματικῶν λόγων ἐν πέρασιν ὡρισμένοις περιλαβὼν καὶ προστησάμενος ἐν τοῖς εἰρημένοις ἀριθμοῖς, ἀφ' ὧν δὴ καὶ τὰ μέτρα τῆς τε εὐγονίας καὶ τῆς ἐναντίας πρὸς ταύτην ἀγονίας καταφαίνεται.* The first sentence means that "powers" play a part in every department of Mathematics as well as in Nature and in Life—"some" (i.e. roots) "having power, while others" (i.e. squares)

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[1] The word *δυνάμεις* is here confined to *irrational* roots, but this is a limitation introduced by Theaetetus. Theaetetus in fact proposes to confine the word *δυνάμεις* to surds, and to use *μῆκος* for the rational roots. The usual meaning of *δύναμις* in Plato's mathematics is "squaring" or "the square," e.g. *Rep.* IX 587 D *κατὰ δὲ δύναμιν καὶ τρίτην αὔξην δῆλον δὴ ἀπόστασιν ὅσην ἀφεστηκὼς γίγνεται.* See on this subject Gow's *History of Greek Mathematics*, p. 78 note 1.

[2] *In Euclidem* (*Teubner edition*), p. 8.

[3] *In Eucl. l. c.*

"are subject to power." For example 3 is *δυνάμενος*, because it has power (viz. over 9—to *make* 9): 9 is *δυναστευόμενος*, because it is subject to power (viz. of 3—to be *made* by 3). It will not be denied that *δυναστεύομαι* is intended by Proclus as the passive of *δύναμαι*[1]. Now *δύναται*, said of a root, means *δύναται τετράγωνον ποιεῖν*. The passive of this, said of a square number, is *δύναται τετράγωνος γίγνεσθαι* (*δύναται ἴσος ἰσάκις γίγνεσθαι* in *Theaet.* 147 E). In the case of the *active*, it was found possible to drop *τετράγωνον ποιεῖν*: but if, in the *passive*, *τετράγωνος γίγνεσθαι* is discarded, at least the passivity must not. For this reason *δύναται* becomes *δυναστεύεται*—if indeed it was not so before, by reason of the passive infinitive[2].

It has thus been shewn that *δυναστευόμεναι* in our passage refers to squares. But before I interpret the expression as a whole, it is necessary to discuss a passage of Alexander Aphrodisiensis, which has not unnaturally been quoted in connexion with section B, since it seems to be the only other passage in which *δυναστεύεται* occurs in mathematical surroundings. The words are[3] *ἀνικίαν δέ φασιν ὑπὸ τῶν Πυθαγορείων λέγεσθαι τὴν πεντάδα, τοῦτο δὲ ὅτι τῶν ὀρθογωνίων τριγώνων τῶν ἐχόντων ῥητὰς τὰς πλευρὰς πρῶτόν ἐστι τῶν περιεχουσῶν ὀρθὴν γωνίαν πλευρῶν ἣ μὲν τριῶν ἣ δὲ τεττάρων, ἡ δὲ ὑποτείνουσα πέντε. ἐπεὶ τοίνυν ἡ ὑποτείνουσα ἴσον δύναται ἀμφοτέραις ἅμα, διὰ τοῦτο ἡ μὲν δυναμένη καλεῖται, αἱ δὲ δυναστευόμεναι, καὶ ἔστι πέντε. τήν τε πεντάδα ἀνικίαν ἔλεγον ὡς μὴ νικωμένην ἀλλ' ἀήττητον καὶ κρατοῦσαν.*

The general drift of the passage is that the Pythagoreans called the number 5 "Never-say-die," because it is the hypotenuse of the first right-angled triangle with rational sides—the one 3, the other 4. As the hypotenuse is *equally powerful*[4] with both the other sides, it is called *δυναμένη*, the others

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[1] The use of the passive is like that in *τιμοκρατεῖσθαι*, *δημοκρατεῖσθαι*, *regnor* and the like. The words *δύνασθαι* and *δυναστεύεσθαι* had also a special astrological sense in Proclus' time: see Schoell's *Procli partes ineditae*, p. 28.

[2] Cf. Lucretius I 1045 dum veniant aliae ac suppleri summa queatur.

[3] In Arist. *Met.* A 8. 990^a 23.

[4] i.e. is equal when squared to the sum of the squares of the other two sides.

δυναστευόμεναι. It is "never-say-die," because it remains unconquered and prevails.

δυναμένη here means "powerful," "prevailing": *δυναστευόμεναι* "subject to power," "prevailed against." Our sympathies being with the hypotenuse, because the odds are against him, we call him conqueror even although the battle is a drawn one. The only bearing of the passage on our text is this: it uses *δυναστευομένη* as a passive of *δυναμένη*. But whereas, in Proclus, *δυναστευόμενα* means "what can be produced by roots" (i.e. squares), and *δυνάμενα* "what can produce squares" (i.e. roots), here *δυναμένη* means "equal, or rather greater in power" (viz. the hypotenuse), and *δυναστευόμεναι* "prevailed against" (viz. the sides). It is evident that the words are used by Alexander less in a technical, than in a metaphorical sense, and with no reference to their occurrence in the Nuptial Number—to which indeed he makes no reference at all. The interpretation of *δυναστευόμεναι* in Plato is given us, not by Alexander, but by Proclus[1].

We are now in a position to interpret fully the words *αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι*. They mean "root-and-square multiplications," i.e. multiplications of roots by squares,—in other words, cubings. Take for example $w \times w^2$, $x \times x^2$, $y \times y^2$. Each of these, taken by itself, is an *αὔξησις δυναμένη τε καὶ δυναστευομένη*: collectively, they are *αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι*. The awkwardness of the English expression "root-and-square multiplications" is escaped by the Greek idiom, because *δυνάμεναι* and *δυναστευόμεναι* are participial adjectives.

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[1] I have treated the words of Alexander seriously, because there is no *a priori* reason why the Pythagoreans should not have called 5 *ἀνικία*, or indeed almost anything else in heaven or earth. But those who know what confusion has arisen from the similarity of vowel in *νεικ-* and *νικ-* may have their suspicions aroused when they read the following from the *Theologumena Arithmetica* (p. 26 ed. Ast): *καὶ ἀνεικίαν προσηγόρευον τὴν πεμπάδα, οὐ μόνον, ἐπειδὴ τὸ πέμπτον καὶ κατ' αὐτὸ τεταγμένον στοιχεῖον, ὁ αἰθήρ, κατὰ ταὐτὰ καὶ ὡσαύτως ἔχων διατελεῖ, νείκους καὶ μεταβολῆς ἐν τοῖς ὑπ' αὐτὸν ὑπαρχόντων ἀπὸ σελήνης μέχρι γῆς, ἀλλ' ὅτι τὰ πρώτιστα διαφέροντα καὶ οὐχ ὅμοια τοῦ ἀριθμοῦ δύο εἴδη, ἄρτιον καὶ περιττόν, αὐτὸς ὡσανεὶ ἐφιλίωσε καὶ συνήρτησε κτλ.* Megillus is quoted to the same effect a few lines lower down, and Ast in his note adds further references. Zeller^4 i p. 369 note 4 regards *ἀνικία* as more original than *ἀνεικία*.

It may be asked, "Why did not Plato express the idea of cubings in a single word?" The reason will appear in Part 2, where the full force of this most exact and elegant expression will be seen.

I come now to the words *τρεῖς ἀποστάσεις, τέτταρας δὲ ὅρους λαβοῦσαι.* These words seem to have been misunderstood by every writer on the Nuptial Number.

Let us first determine the meaning of *λαβοῦσαι.* If *δέος λαμβάνει με* (*Laws* III 699 C), I am afraid, if *ἐπιθυμία* (*Crito* 52 B), I desire—if *αὔξησις*, what happens to me? *αὐξάνομαι.* It is in vain that "cubings" lay hold on me, if I am not cubed[1].

Next, what are *τρεῖς ἀποστάσεις, τέτταρας δὲ ὅρους*? Plato himself shall tell us. In the *Republic* (IX 587 D, quoted above on p. 26) we find: *κατὰ δὲ δύναμιν καὶ τρίτην αὔξην δῆλον δὴ ἀπόστασιν ὅσην ἀφεστηκὼς γίγνεται.* In the *Timaeus* (43 D) *τὰς τοῦ διπλασίου καὶ τριπλασίου τρεῖς ἑκατέρας ἀποστάσεις.* The meaning of *ἀπόστασις* in the first place is "distance from" (sc. true pleasure): *τριπλασίου ἄρα*, says Plato, *τριπλάσιον ἀριθμῷ ἀληθοῦς ἡδονῆς ἀφέστηκε τύραννος.* In the second the word means "the distances of 2 from 1, 4 from 2, 8 from 4" (*τὰς τοῦ διπλασίου ἀποστάσεις*), and "the distances of 3 from 1, 9 from 3, 27 from 9" (*τὰς τοῦ τριπλασίου ἀποστάσεις*), as is manifest from *Timaeus* 35 B. *τρεῖς ἀποστάσεις* means therefore "three distances from." But distances from what? We shall see in Part 2 that *ἀποστάσεις* means distances from the moment of conception, which is regarded as the unit or point[2]. The *ἀποστάσεις* are limited by four ὅροι, each ἀπόστασις being only a μεθόριον[1]; so that τέτταρας ὅρους means "four limits"—four ὅροι τῶν διαστημάτων (*Phil.* 17 D). Here the limits are points: αἱ στιγμαὶ τῶν μεγεθῶν ὅροι[2]. δέ in τέτταρας δὲ ὅρους implies a latent μέν after τρεῖς[3].

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[1] The word *λαβοῦσαι*, which is perhaps the simplest in the whole passage, cost me more labour than any other single word. Nicomachus (*Inst. Arithm.* p. 143 ed. Ast, quoted by Schneider on p. xxxi) induced me to believe at first that it was an obscure mathematical term for "multiplying," but I persisted, refusing to believe that Plato is obscure, and the meaning flashed on me at last. I am not sure that Nicomachus was not on the way to discover the meaning of this word, but he did not understand the passage as a whole.

[2] *ἀπόστασις* is used in the same arithmetical sense by Nicomachus, ed. Ast p. 5, where he says (speaking of the unit) *ὁπόσαις γὰρ ἂν αὐξηθῇ ἀποστάσεσιν ἢ ὁπόσας ἂν αὐξήσῃ θεῖν πρόσω κωλύει κτλ.*

Now let *AB*, *BC*, *CD* be three ἀποστάσεις (Fig. vi), and *A*, *B*, *C*, *D* the 4 ὅροι which confine them—what then are *AB*, *BC*, *CD*? We recognise our old friend in repose. Take him up tenderly, lift him with care, and lo! (Fig. vii).

Fig. vi.

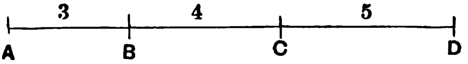
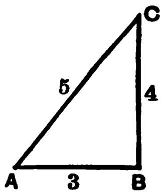


Fig. vii.



Three, four, and five are the only three numbers the sum of whose cubes will produce the number 216, which we have seen to be the whole number of B.

There remain the words ὁμοιούντων τε καὶ ἀνομοιούντων καὶ αὐξόντων καὶ φθινόντων. These words are not here used with any geometrical or arithmetical meaning, and it will be shewn in Part 2 that they denote months and nothing more. They tell us in what the ἀποστάσεις consist: it is "distances of months," "distances in months" with which we have to deal, for the three ἀποστάσεις, as we shall see, are the third, fourth, and fifth months after a child has been conceived. The individual words will be explained on p. 54: in the meantime I will only remark that the intransitive use of αὔξω seems not to occur elsewhere in Plato, though it is frequent in Aristotle, as a glance at the *Index Aristotelicus* will shew. In connexion with *φθίνω*, the intransitive use of *αὔξω* is not unnatural, and harmonises with the lofty poetic diction of the Muses.

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[1] ἔστι δὲ οὐ πάντων, ὡς ἔοικε, τῶν ὄντων ὅρος ὅρῳ προσμιγνύς, ἀλλ' οἷς ἔστι μεθόριον, τοῦτο ἐν μέσῳ ὅρων πρότερον ἑκατέρῳ προσβάλλον γίγνοιτ' ἂν ἀμφοῖν μεταξύ *Laws* IX 878 B.

[2] Cf. Arist. *Met.* N 5, 1092^b 9.

[3] Cf. *Theaet.* 181 D δύο δὴ λέγω τούτω εἴδη κινήσεως, ἀλλοίωσιν, τὴν δὲ φοράν.

I do not propose to comment on *πάντα προσήγορά τε καὶ ῥητά* till Part 2, further than to say that these words refer to some kind of *ἁρμονία*. As according to the Pythagoreans every cube is a *ἁρμονία*[1], a *ἁρμονία* may well be supposed to result from the sum of two or more cubes. Just so we are told by Plutarch[2] that the Pythagoreans called the number 35 a *ἁρμονία* because 35 is equal to the sum of two cubes, viz. 2^3 and 3^3.

The meaning of the section which I have called B is therefore as follows: The period of gestation for a human creature is measured by the first number which contains $w \times w^2$, $x \times x^2$, and $y \times y^2$; w, x, and y denoting three distances in months from the time of a child's conception, and these multiplications rendering all things conversable and rational towards one another. Now we have seen that 216 is the whole number of B; and $w \times w^2$, $x \times x^2$, $y \times y^2$, are contained in 216, if we put $w = 3$, $x = 4$, $y = 5$, since $216 = (3 \times 3^2) + (4 \times 4^2) + (5 \times 5^2)$.

* * *

The foregoing discussion may be summed up in these equations, in which w, x and y are 3, 4 and 5, the sides and hypotenuse of the Pythagorean triangle:

$$(1) \quad w^3 + x^3 + y^3 = z = 216.$$

$$(2) \quad [(w + x + y) \times 5]^4 = 3600^2 = 4800 \times 2700.$$

It will be observed that in the left-hand member of both equations no number occurs which is not the number of a side in the Pythagorean triangle, and further, that in the second equation the numbers of the sides of this triangle virtually occur twice over, viz. first in $w + x + y$, i.e. $3 + 4 + 5$, and second, when we multiply the sum of these terms, which are 3 in number, by 5, and raise the product to the power denoted by 4.

Thus are the symbols on the Sibyl's leaves deciphered: in Part 2 their meaning will be read.

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[1] See Cantor *Gesch. der Mathem.* p. 140.

[2] *περὶ τῆς ἐν Τιμαίῳ ψυχογονίας* XII 1017 F.

PART 2.

THE SIGNIFICANCE OF THE NUPTIAL NUMBER.

THE plan of this part of my discussion will be as follows:

Chapter I. Translation of the passage.
Chapter II. The Significance of the Nuptial Number.

Chapter II is divided into the following sections:

Section 1. Introductory.
„ 2. The point of view discovered.
„ 3. The meaning of the words from *χαλεπὸν μέ*
to *γεννήσουσι παῖδάς ποτε οὐ δέον.*
„ 4. The *περίοδος* of the *θεῖον γεννητόν.*
„ 5. The *περίοδος* of the *ἀνθρώπειον γεννητόν.*
„ 6. The Diapason.
„ 7. The Number 36000.
„ 8. Conclusion.

CHAPTER I.

TRANSLATION.

545 D. How then, Glaucon, said I, shall our city be moved, and in what way will the auxiliaries and the rulers become seditious towards one another and towards themselves? or shall we pray like Homer to the Muses to tell us "how first sedition entered," and shall we, like a tragedian[1], picture[2] them speaking in a lofty style, as if they were speaking seriously, whereas they are playing with us, like one child with another, and making banter? How? In some such style as this: Difficult it is, indeed, for a city so compounded to be moved; but since for everything that is born there is destruction, neither will such a compound as ours last for all time, but be dissolved. The dissolution is as follows: Not only to plants within the ground, but also among animals upon the ground, cometh fertility and infertility of soul and bodies, as often as their revolutions make the circumferences of the respective circles complete their course[3], faring a short way in those whose life is short, and the reverse in the reverse. Now as touching your kind[4], clever though the leaders of the city be whom you saw educated, none the more will they by calculation together with perception attain to due fecundity and barrenness, but it will escape them, and they will one day beget children when they ought not. Now for a divine creature there is a period which

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[1] *τραγικῶς*. Homer was *τῶν καλῶν ἁπάντων τούτων τῶν τραγικῶν πρῶτος διδάσκαλός τε καὶ ἡγεμών* according to Plato (*Rep.* x 595 c).

[2] Read *θῶμεν*.

[3] *Lit.* "revolvings join for each the circumferences of their circles"—sc. to the point where they began to revolve —"for short-lived &c."

[4] i.e. human kind: it is the Muses who are speaking.

is comprehended by a number that is final, and for a human the number is the first in which multiplications of root by square, having laid hold on three distances, with four limits, of that which maketh like and unlike and waxeth and waneth, have rendered all things conversable and rational with one another: whereof the base, containing the ratio of four to three, yoked with five, furnishes two harmonies when thrice increased: the one equal an equal number of times, so many times a hundred, the other of equal lengths one way, the other way unequal;—on the one side, of one hundred squares rising from rational diameters of five diminished by one each, or if from irrational diameters by two; on the other, of one hundred cubes of three. The sum of these, a number measuring the earth, is lord of better and worse births, which not knowing, when your guardians marry brides to bridegrooms out of season, children of ill nature and ill fortune will be born: whereof the best their predecessors will indeed make rulers; nevertheless, being unworthy, when they have succeeded to their fathers' offices of power, us[1] they will first begin to heed not though they are our guardians, having set too little store by music first and second by gymnastic[2], and so our[3] children will grow up without us. And the rulers who succeed them will have little of the guardian in them to prove Hesiod's races and your own,—races of gold and silver and copper and iron. And, iron mixed with silver, and copper with gold, unlikeness will arise within, and inequality wherein there is no harmony, which evermore breed war and enmity, whereinsoever they arise. This surely is the pedigree of Sedition, wherever she arises, evermore.

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[1] i.e. the Muses.

[2] The reading of A is right. Full well do the Muses know that he who despises *μουσική* will hate *γυμναστική* ere long, for *γυμναστική* as well as *μουσική* educates the soul and not the body (*Rep.* III 410 c ff.). 548 c is no excuse for Madvig's distressing change to *δεύτερά τε γυμναστικῆς*.

[3] A is right again; and there is no more tender touch in Plato's writings. Whoso sees it not, let him go and "sacrifice to the Graces."

CHAPTER II.

THE SIGNIFICANCE OF THE NUPTIAL NUMBER.

Section 1. *Introductory.*

I HAVE endeavoured throughout the foregoing discussion to confine myself strictly to interpreting the Greek, because we cannot hope to understand what Plato meant until we first know what he said. Wherever the full discussion of a word or phrase would have led us to inquire into the significance of the Nuptial Number, I have postponed it till the present chapter, as in the case of the words *πρώτῳ*, *αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι*, *πάντα προσήγορά τε καὶ ῥητὰ πρὸς ἄλληλα ἀπέφηναν*, and *ἁρμονίας*. But as it is certain that Plato meant something when he wrote the number, and something moreover which contributes to the harmony of the Republic, we must attempt to shew that the results which we have reached do but swell the music of the whole. If we fail, the previous discussion is in no way affected, for it can only be shaken by shaking its foundation—my interpretation of the Greek. Thanks to the abundance of collateral evidence which we possess, it is fortunately easier to discover Plato's meaning than it was to elucidate his language.

Before I enter on this section of the discussion, it is necessary to say something of the interpretation proposed by Hultsch. I had reached the present stage in my investigations when I first read his article. Gow[1] had led me to believe that Hultsch's solution of the Second Number was 216,000: what was my surprise and delight to find that it was really 12,960,000, and so far absolutely identical with my own! I read his article with the avidity of Socrates when he devoured the περὶ φύσεως of Anaxagoras[1], and wondrous was the hope from which I was cast adrift, ἐπειδὴ προιὼν καὶ ἀναγιγνώσκων ὁρῶ ἄνδρα τῷ μὲν νῷ οὐδὲν χρώμενον οὐδέ τινας αἰτίας[2] ἐπαιτιώμενον εἰς τὸ διακοσμεῖν τὰ πράγματα, ἀέρας δὲ καὶ αἰθέρας καὶ ὕδατα αἰτιώμενον καὶ ἄλλα πολλὰ καὶ ἄτοπα, after he had said, with no uncertain voice, ὡς ἄρα νοῦς ἐστιν ὁ διακοσμῶν τε καὶ πάντων αἴτιος. The first number, 216, he obtains, with Dupuis, not from the Pythagorean triangle, but from $2^3 \times 3^3$, the smallest number in which each member of the two scales 1, 2, 4, 8 and 1, 3, 9, 27, is contained as a factor. This he hardly attempts to prove himself, referring us to Dupuis for the different steps: "Alle diese Beziehungen werden von Herrn Dupuis, zum Theil nach dem Vorgange früherer, so zweifellos dargestellt, dass ich darüber nur zu referiren hatte[3]." Hultsch's compliment so worked upon Dupuis that the latter gave up what he had so "zweifellos dargestellt" before the year was out[4]. Men have been known to sing a palinode when there was no need, but Dupuis did wisely to recant: he would have done more wisely had he done no more[5]. In dealing with the Second Number Hultsch arrives at 12,960,000 by multiplying 36^2 by 100^2 (so he interprets τὴν μὲν ἴσην ἰσάκις, ἑκατὸν τοσαυτάκις), and he equates this with the rectangle (τὴν δὲ ἰσομήκη μέν πη[6], προμήκη δέ) by making the sides of the latter $100 \times 7\sqrt{7-\frac{1}{7}}$ and $100 \times 3^3\sqrt{7-\frac{1}{7}}$. The ἐπίτριτος πυθμὴν πεμπάδι συζυγεὶς τρὶς αὐξηθείς he explains as $(3+4+5) \times 3$. "So sind wir ganz sicher bis zur Zahl 36 vorgeschritten." Then in some mysterious way this number 36 furnishes two harmonies, the one $36^2 \times 100^2$ and the other the rectangle which I have just described. I know not whether Hultsch believes this explanation, but for my own part the impression which his article has left upon my mind is exactly what it left upon

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[1] p. 99.

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[1] *Phaedo* 97 c.

[2] i.e. a study of the Greek.

[3] p. 43.

[4] Cf. Seconde Interprétation p. 9 ff. with Nouvelle Interprétation p. 24 ff.

[5] Besides his Seconde Interprétation, Dupuis has also written on the same subject a Troisième Mémoire, which is now out of print.

[6] He changes τῇ into πῃ.

Dupuis': "L'éminent professeur dit en effet: l'interprétation, qui est dans l'obscurité depuis deux mille ans, n'est pas encore trouvée: mais quelques nouveaux points de vue se sont offerts qui paraissent propres à donner une solution prochaine[1]." I venture to think that the illustrious metrologist made up his mind what the number ought to be from his familiarity with the Babylonian sexagesimal system, and afterwards tried to find it in the Greek. The present solution of the Nuptial Number proceeds on the opposite lines: but it owes no little to the man who has shewn us, more clearly I think than any of his predecessors, where to look for confirmations of our result[2].

So much was due to the *di quibus imperium est pelagi, quorum aequora curro.*

Section 2. *The point of view discovered.*

We shall first obtain our point of view from Plato himself, and, from it, afterwards interpret the expressions in detail.

Our city, says Plato, will be moved, when *στάσις* appears in the two higher classes. The Muses shall tell us how *στάσις* entered first. The *cause* of our city's being moved, they say, is that everything created is liable to destruction. The *process* of destruction (*λύσις*) is when the leaders of the city *γένους ὑμετέρου εὐγονίας τε καὶ ἀφορίας—οὐδὲν μᾶλλον τεύξονται, ἀλλὰ πάρεισιν αὐτοὺς καὶ γεννήσουσι παῖδάς ποτε οὐ δέον.* Whenever, in ignorance of 'better and worse births,' *οἱ φύλακες συνοικίζωσι νύμφας νυμφίοις παρὰ καιρόν, οὐκ εὐφυεῖς οὐδ' εὐτυχεῖς παῖδες ἔσονται.* In the next generation the dissolution has already gone so far that iron breeds with silver, and copper with gold.

Accordingly the *λύσις* of the ideal state is *the begetting of children when children ought not to be begotten,* or briefly, *the begetting of children out of season*[3].

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[1] Seconde Interprétation p. 4. The words are practically translated from Hultsch himself; see p. 56.

[2] p. 51 ff.

[3] The words *γεννήσουσι παῖδάς ποτε οὐ δέον* mean literally 'they will one day beget children when they ought not to' and may refer, not simply to unions at the wrong season, but also to the unions of wrong couples, or the like. That Plato here means unions 'out of season' is made probable by

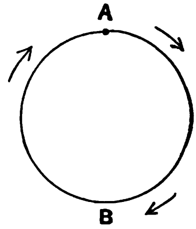
This is confirmed by Aristotle[1], who after stating that the number which we have seen to be 216 is, according to Plato, the *ἀρχή* of change, adds the explanatory remark *ὡς τῆς φύσεώς ποτε φυούσης φαύλους καὶ κρείττους τῆς παιδείας*. It receives additional support on a reference to those passages in Book V where it is ordained that bridegrooms and brides are to be brought together at certain fixed times. Thus in 458 D when the male and female archons fall in love, they are not allowed *ἀτάκτως μίγνυσθαι*, but marriages are to be celebrated *ἱεροὶ εἰς δύναμιν ὅτι μάλιστα*. In 459 E it is said: *οὐκοῦν δὴ ἑορταί τινες νομοθετητέαι, ἐν αἷς ξυνάξομεν τάς τε νύμφας καὶ τοὺς νυμφίους, καὶ θυσίαι καὶ ὕμνοι ποιητέοι τοῖς ἡμετέροις ποιηταῖς πρέποντες τοῖς γιγνομένοις γάμοις*. And at 461 A it is reckoned a sin against God and man to produce a child for the state *οὐχ ὑπὸ θυσιῶν οὐδ' ὑπ' εὐχῶν φὺς ἃς ἐφ' ἑκάστοις τοῖς γάμοις εὔξονται καὶ ἱέρειαι καὶ ἱερεῖς καὶ ξύμπασα ἡ πόλις κτλ.*

Section 3. *The meaning of the words from χαλεπὸν μέν to γεννήσουσι παῖδάς ποτε οὐ δέον.*

We have thus obtained the point of view from which the whole passage is to be interpreted. While the *cause* of change from the best to the second-best commonwealth lies in the perishability of everything which is created, the *process* which leads to change is the begetting of children out of season. Let us now unravel Plato's meaning by this clue.

Plato deals first with the process leading to change (λύσις). To plants and animals, he says, cometh production or non-production (a crop or no crop) of soul and bodies, whenever revolutions join for each the circumferences of their circles, these circumferences faring a short way for the short-lived, but the reverse for the reverse. That is to say, plants and animals have fixed periods of gestation, which may be represented by

Fig. viii.



παρὰ καιρόν below as well as by the words of Aristotle (to be presently referred to): in the sequel it will be shewn to be certain.

[1] See above p. 22.

circles whose circumferences revolve (Fig. viii). Every time that the fixed point A is reached, there is *φορὰ ψυχῆς τε καὶ σωμάτων*, if the seed was sown on the last occasion when the same point of the circle was at A, and if it has come, without accident, to maturity: if however the seed was not then sown, or, though sown, has not come to maturity, there is *ἀφορία ψυχῆς τε καὶ σωμάτων*. The singular *ψυχή* is used because soul, viewed as the principle of life, is one in all plants, in all animals, and in both[1]. Why are the circumferences long in the case of long-lived animals, and short in the case of short-lived? Simply because animals that live long have long periods of gestation, and conversely. Aristotle takes note of the same general rule in his *Problemata*[2]: *διὰ τί τὰ μὲν ταχυτόκα τῶν ζῴων ἐστί, τῶν δὲ πολυχρόνιος ἡ κύησις; ἢ ὅτι τὰ μακροβιώτερα βραδύτερον πέφυκε τελειοῦσθαι; ἔστι δὲ βραδυτόκα τὰ μακρόβια.*

The meaning of the words from *λύσις δὲ ἥδε* to *ἐναντίας* may therefore be summed up in the sentence: In all plants and animals the period of gestation is fixed by nature. Now as man is the animal with whom in the ideal state we are concerned, we are prepared by this exordium for the mention of the period of gestation in the human race. It will come in due time.

Plato proceeds to narrow the case down to man: "Now as touching your kind (i.e. mankind), clever though the leaders of the city be whom you saw educated, none the more will they by calculation together with perception obtain" (literally, *hit the obtaining of*) "good offspring and no offspring, but this" (i.e. *εὐγονία τε καὶ ἀφορία*) "will escape them, and they will one day beget children when they ought not." Several points in this require to be explained. First: in place of repeating *φορὰ καὶ ἀφορία* Plato writes *εὐγονίας τε καὶ ἀφορίας*, because it is not enough for the prosperity of the ideal state, merely to produce children—the children must be good in quality. The word *ἀφορίας* is full of meaning; it is the duty of the rulers to render, if possible, illicit unions unproductive, *πάντα διακελευσάμενοι προθυμεῖσθαι, μάλιστα μὲν μηδ' εἰς φῶς ἐκφέρειν*

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[1] Cf. *Tim.* 77 B.

[2] x 9 p. 891^b 25.

κύημα μηδέ γ' ἕν, ἐὰν γένηται, ἐὰν δέ τι βιάσηται, οὕτω τιθέναι, ὡς οὐκ οὔσης τροφῆς τῷ τοιούτῳ (v 461 c). Second: how does 'calculation together with perception' help the archons in their efforts to obtain good offspring and avoid bad? It is by the process which these words describe that the archons try to learn *at what times the unions should take place.*

In the pages which follow, the truth of this proposition will be made manifest: but a few words are necessary now by way of caution and of explanation. It may be thought that the words *λογισμῷ μετ' αἰσθήσεως* refer to the faculty or process by which the rulers select the couples whose offspring will be good, not to that by which they determine the time of mating. This is not so, for, as far as choosing the right parents is concerned, the rulers have already abundant means at their disposal. *Ex hypothesi*, being as yet *τέλεοι φύλακες*, they thoroughly know the quality of every member male and female of the two higher classes, and Plato has provided them with the 'medicinal lie'—the *κλῆροί τινες κομψοί* (v 459 c—460 a)—for bringing together the best men and women. But if it be allowed that the season of our begetting may have seemed to Plato to affect our destiny, we should expect him to provide his archons with some means of determining the right season, so far as the laws of nature will permit; and no such instrument has hitherto been put into their hands. We have indeed been told that state-marriages are not to take place at random, but on certain holy festivals, with every circumstance of pomp and splendour, but we have not been told by what method the dates of these festivals should be fixed. The method is *λογισμὸς μετ' αἰσθήσεως*, and in the end it fails, from no fault of our rulers, but, as we shall see, *διὰ τὸ μὴ μένειν μηδὲν ἀλλ' ἅπαντα ἔν τινι περιόδῳ μεταβάλλειν*, because "the great world spins for ever down the ringing grooves of change." So much by way of caution. By way of explanation I would say this. Plato may well have wondered (see for example *Protagoras* 319 a—320 c) why the children of good parents are often bad, and conversely, and it is not unreasonable to suppose that he attributed this in part to their having been begotten at wrong seasons. In the face of the unfathomable mysteries of human fate, who shall say that he was wrong? Not Hesiod[1], whom he continually follows, nor, I imagine, Hippocrates or Aristotle, or the Asclepiads of to-day. It is one thing to hold that we may safely disregard as an unknown quantity, if indeed it is unknown, the influence which the season of their conception exercises on human creatures, and another to say that it has none: the man who is wise because he knows his ignorance will stop short of the dogmatic 'no.' For us, however, the interesting point to notice is that Plato thought we are in some measure affected by the season of our begetting. As surely as Nature has appointed for all animals, including man, a fixed period of gestation, so surely has she ordained times and seasons for their procreation, and they who disobey her, steering their lives by *ἡδονή* rather than by *ὠφέλιμον*, shall surely pay the penalty, if not in their own persons, in the persons of those by whom they fain would make themselves immortal[2], and finally in "red ruin and the breaking up of laws." Such was the doctrine of Plato when he wrote the *Republic*, and such it remained to the end[3].

Section 4. *The περίοδος of the θεῖον γεννητόν.*

We come now to the words *ἔστι δὲ θείῳ μὲν γεννητῷ περίοδος ἣν ἀριθμὸς περιλαμβάνει τέλειος.* Plato has stated that all *ζῷα* have a fixed period of gestation: he now proceeds to specify the periods of (1) the *θεῖον γεννητόν* and (2) the *ἀνθρώπειον*, beginning with the *θεῖον*, on the principle *ἐκ Διὸς ἀρχώμεσθα.*

Four expressions require to be discussed before we can arrive at Plato's meaning—viz.: *περίοδος, περιλαμβάνει, ἀριθμὸς τέλειος*, and *θεῖον γεννητόν.*

The word *περίοδος* means nothing more than 'way round.' One complete revolution of any circle is a *περίοδος*: two or more of the same circle, or one (or more) of one circle and one (or more) of another or others, are *περίοδοι.* This will not be denied by any one who will take the trouble to study side by side the examples quoted in Ast's Lexicon of the use of *περίυδος* in Plato. In the present passage the 'way round' is that described above in the words *ὅταν περιτροπαὶ ἑκάστοις κύκλων περιφορὰς ξυνάπτωσι*: the *περίοδος* of a *θεῖον γεννητόν* is therefore fulfilled *ὅταν περιτροπὴ θείῳ γεννητῷ κύκλου περιφορὰν ξυνάπτῃ*. Now it has been shewn that the words from *ὅταν περιτροπαί* to *ξυνάπτωσι* refer to periods of gestation: we are therefore forced to the conclusion that the *περίοδος* of a *θεῖον γεννητόν* is nothing more or less than the period of gestation which ends in the birth of a Divine Creature[1]. This is at first sight startlingly anthropomorphic, and will appear to some readers about as unlike Plato as anything well could be, but let them reserve their judgment for a little. Were it ever so anthropomorphic, as I shall shew that it is not, I would rather believe that Plato's view of the Divine was as gross as that of his countrymen whom Xenophanes satirised so well[2], than hold him guilty in one of the most finished passages which he ever wrote, of using a word which he has just explained, in a sense other than his explanation gave to it, and then in the very next sentence, which hangs so closely with the preceding that he actually does not think it necessary to repeat the word, giving to it again the meaning which he has already said that it bears.

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[1] *Works and Days* 780—794.

[2] *Symp.* 208 A ff.

[3] See *Laws* VI 773 A ff., 783 D ff.

The word *περιλαμβάνει* means 'comprehends.' If a number is represented by a rectangle, its sides, or factors, are said to 'comprehend' it, as in *Theaet.* 148 A, *τὸν τοίνυν μεταξὺ τούτου, ὧν καὶ τὰ τρία καὶ τὰ πέντε καὶ πᾶς ὃς ἀδύνατος ἴσος ἰσάκις γενέσθαι...μείζων δὲ καὶ ἐλάττων ἀεὶ πλευρὰ αὐτὸν περιλαμβάνει...προμήκη ἀριθμὸν ἐκαλέσαμεν.* In the present case, we are dealing, not with a number, but with a *περίοδος* which is comprehended by a number, and that number *περιλαμβάνει*

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[1] For *περίοδος* in the sense of 'period of gestation,' cf. Aristides Quint. *De Musica*, p. 143, *ταῖς τῶν ἑπταμήνων περιόδοις*. Aristides thoroughly understood this part of the number.

[2] Mullach's *Frag. Phil. Graec.* Vol. I p. 102

ἀλλ' εἴτοι χεῖράς γ' εἶχον βόες ἠὲ λέοντες,
ἢ γράψαι χείρεσσι καὶ ἔργα τελεῖν ἅπερ ἄνδρες,
ἵπποι μέν θ' ἵπποισι, βόες δέ τε βουσὶν ὁμοίας
καί κε θεῶν ἰδέας ἔγραφον καὶ σώματ' ἐποίουν
τοιαῦθ', οἷόν περ καὐτοὶ δέμας εἶχον ὁμοῖον.

περίοδον which gives the time that the revolution takes to accomplish. The period of gestation of a Divine Creature is therefore expressed by a 'final number.'

I will now discuss the words *τέλειος ἀριθμός*. It is well known that a 'perfect' number meant to Euclid[1] and Greek arithmeticians generally a number which is equal to the sum of its divisors, e.g. $6 = 1 + 2 + 3$; $28 = 1 + 2 + 4 + 7 + 14$. But there is not a trace of such a meaning in Plato, nor in the fragments of Philolaus[2], and even among the later Pythagoreans numbers are often called 'perfect,' although they are not equivalent to the sum of their factors[3]. The *τέλειος ἀριθμός par excellence* was 10 according to the Pythagoreans: *θεωρεῖν δεῖ τὰ ἔργα καὶ τὰν ἐσσίαν τῶ ἀριθμῶ κattὰν δύναμιν, ἅτις ἐστὶν ἐν τᾷ δεκάδι· μεγάλα γὰρ καὶ παντελὴς καὶ παντοεργὸς καὶ θείω καὶ οὐρανίω βίω καὶ ἀνθρωπίνω ἀρχὰ καὶ ἁγεμὼν καὶ κοσμήτειρα ἁ δύναμις ἁ τᾶς δεκάδος*[4]. But 10 was called by them *παντελής* or *τέλειος* simply because, as the basis of their system of calculation, which was a decimal one, it may be regarded as the 'consummating' or 'all-ending' number, the numbers above ten being considered merely repetitions of the first ten[5]. Plato was perfectly at liberty to call any other number *τέλειος* which 'ends' or 'brings a consummation[6].' Let us see whether he does so. In the *Timaeus*, p. 39 D, we find the words: *ἔστι δ' ὅμως οὐδὲν ἧττον κατανοῆσαι δυνατόν, ὡς ὅ γε τέλειος ἀριθμὸς χρόνου τὸν τέλειον ἐνιαυτὸν πληροῖ τότε, ὅταν ἁπασῶν τῶν ὀκτὼ περιόδων τὰ πρὸς ἄλληλα ξυμπερανθέντα τάχη σχῇ κεφαλὴν τῷ τοῦ ταὐτοῦ καὶ ὁμοίως ἀναμετρηθέντα κύκλῳ.* It is rightly held that we have here a reference to a Great Year—the period within which all the eight spheres[1] revolving around the (simultaneously reach the point from which they started a commencement of our cycle, and at the end of whicl will be afterwards seen[2]) Plato, like many other philoso] said that the Universe was not indeed annihilated, but ir at least dissolved. From the fact that the same words, τ(*ἀριθμός*, are used both of the number in the *Timaeus* a] the number of the *θεῖον γεννητόν*, we may provisionally that these two numbers, the one expressing the durati the World, and the other the period of gestation for a D Creature, are identical. This will be fully established late:

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[1] Euclides *Elem.* VII def. 23 *τέλειος ἀριθμός ἐστιν ὁ τοῖς ἑαυτοῦ μέρεσιν ἴσος ὤν*

[2] Some of Philolaus' fragments, whether genuine or not, are at all events tolerably early.

[3] e.g. 3 and 9: see the *Theolog. Arithm.* pp. 13, 58 (ed. Ast). The number 3 is on p. 13 said to be *τέλειος ἰδιαίτερον τῶν ἄλλων*, implying that other numbers may also be *τέλειοι*, though in a less specific sense. Cf. Demme (referred to on p. 11) pp. 84—85. The rest of Demme's article is radically unsound throughout.

[4] Philol. *Frag.* 13 in Mullach II p. 4.

[5] See Zeller *Phil. der Griech.*[4] I p. 367 note 4, and Aristotle quoted there.

[6] Cantor in his *Vorlesungen zur Gesch. der Math.* p. 142 agrees with me in denying that 'perfect number' here means 'a number equal to the sum of its divisors.'

There remain the words *θείῳ γεννητῷ*. The ancients plained these words, with perfect justice, as referring t(Universe: *οὐρανὸς ἢ κόσμος ἢ καὶ ἄλλο ὅ τί ποτε ὀνομαζό*, *μάλιστ' ἂν δέχοιτο, τοῦθ' ἡμῖν ὠνομάσθω* (*Tim.* 28 B). I *Timaeus* there is abundant evidence that Plato regardec World as a Divine Creature; *τόνδε τὸν κόσμον*, he says, *ἔμψυχον ἔννουν τε τῇ ἀληθείᾳ διὰ τὴν τοῦ θεοῦ γενέ*

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[1] viz. the circle of the Fixed stars, Saturn, Jupiter, Mars, Mercury, Venus, Sun, Moon: see *Rep.* x 507 A ff. There is a good definition of the Great Year in Macrob. *Somn. Scip.* II 11, 10.

[2] p. 68.

[3] p. 69.

[4] See Plutarch *περὶ τῆς ἐν* Τιμαίῳ *ψυχογονίας* x 1017 c, and the references in Schneider. The scholiast (apparently Proclus; see Schoell p. 21) whom he quotes gives to the words *θεῖον γεννητόν* a somewhat wider sense than I think the *Timaeus* will allow us to assign to them: *θεῖον γεννητὸν οὐ τὸν ὅλον φησὶ κόσμον, εἰ καὶ προηγουμένως τοῦτον... ἀλλὰ πᾶν τὸ ἀεικίνητον καὶ περιφερόμενον.* But if such a view is right, then an *ἀνθρώπειον γεννητόν*, since it also is a *περιφερόμενον*, is a *θεῖον γεννητόν*, whereas Plato here opposes the two *γεννητά* to each other as if they were distinct. The scholiast's view rests really on a mistranslation: he takes *θεῖον γεννητόν* as 'created by gods,' not 'divine creature,' and so includes un the creations of the created gods *Timaeus*—e.g. man, birds and —everything in fact which has a but Plato does not here call divine. Proclus is nearer the when he observes (*In Tim.* 2 *ἔτι τοίνυν ἐκείνου* (sc. *τοῦ ὡς* (*χρόνου*) *τὰ μέτρα πάντα περιέχοντ εἰδῶς, καθ' ἃ καὶ ταῖς ψυχαῖς αἱ π καὶ τοῖς σώμασιν ἐπιτελοῦνται καὶ μέτρον τῆς ὅλης ἀποκαταστάσεως γὰρ θείου γεννητοῦ περίοδος, ἣν ἀ περιλαμβάνει τέλειος, ὥς πού φησι* Πολιτείᾳ Σωκράτης), *οὗτος ὁ χρόν ριστικός ἐστι τῶν μέτρων τ ταῖς ψυχαῖς ἢ σωματικαῖς φ καὶ φρουρητικός.* It is true, an is the whole point of the Nuptial ber, that the *περίοδος* of the *θεῖον τόν* seemed to Plato to *control* th *νητά* which are within it, but thi different thing from saying th *θεῖον γεννητόν* is *πᾶν τὸ περιφερόμ*

πρόνοιαν[1]: with which compare the words of Proclus (*in Tim.* 89 D): *ὅταν δὲ ἔμψυχον αὐτὸ καὶ ἔννουν ἴδῃς, θεὸν αὐτὸ καλέσεις, ὅπερ ὁ Πλάτων ἐν Πολιτείᾳ μὲν θεῖον γεννητόν, ἐνταῦθα δὲ θεὸν εὐδαίμονα προσειπεῖν τὸν κόσμον ἠξίωσε.* The Universe is *θεῖον*, because it is a God; *γεννητόν*, because it is created[2].

The *θεῖον γεννητόν* is therefore the World, and we have thus reached this (at first sight) somewhat curious result. *The period during which the World is in the womb is of the same duration as the period during which the World lives.* In other words, the Universe takes as long to make as to unmake: the time of its making is expressed by an *ἀριθμός* which fulfils (*τελειοῖ*)[3] its growth, the time of its unmaking by the self-same number fulfilling its destruction. It needs no mythical interpretation to enhance the splendour of this idea, the full significance of which will be explained in Section 6.

Section 5. *The περίοδος of the ἀνθρώπειον γεννητόν.*

The general statement, with which we started, that every living thing has a fixed period of gestation, has now at last been narrowed down to man. The period of gestation for a human creature, says Plato, is the "first number in which root-and-square multiplications, having laid hold on three distances, etc., will make all things" (i.e. all things in the development of the child within the womb) "conversable and rational towards one another."

We have seen that the three distances are 3, 4, and 5: and 216 is the number in which 3×3^2, 4×4^2, and 5×5^2 are found. Plato declares that 216 is the shortest number of days that can elapse between conception and the birth of a fully developed child, and this is the full meaning of *πρώτῳ*. It is fortunate that Aristides Quintilianus[1], in the passage to which we have already referred[2] as full of allusions to the Nuptial Number, helps us here again. Speaking of the Pythagorean triangle, he says: *ἀλλ' εἰ καὶ τῶν πλευρῶν ἑκάστην κατὰ βάθος αὐξήσαιμεν (βάθος γὰρ ἡ σώματος φύσις) ποιήσαιμεν ἂν τὸν διακόσια δεκαέξ, ἰσάριθμον ὄντα σύνεγγυς τῷ τῶν ἑπταμήνων. πάλιν δὲ τὰς τρεῖς ἐπ' ἀλλήλους κατὰ βάθος ποιήσαντες, καὶ τῷ προειρημένῳ προσθέντες* (i.e. $[3 \times 4 \times 5] + 216 = 276$), *τὸν τῶν ἐννεαμήνων συντίθεμεν διακόσια ἑβδομηκονταέξ*. As 210 and 270 days were generally regarded as the periods respectively of a seven and a nine months' child, he adds: *ἐν ἀμφοτέροις δὲ ὁ ἓξ περιττεύει, γαμικὸς τυγχάνων δι' αἰτίαν*[3]. It is curious that Plato should have selected the period of the seven months' child as the period ordained by nature, but on this subject the opinions of the ancients differed very widely, as we may see from Censorinus[4], who observes "quoto post conceptionem mense infantes edi soleant, frequenter agitatum inter veteres nondum convenit." In Book v (461 D) he recognises both the longer and the shorter periods, and we shall see that room is made for both of them in a later part of the Nuptial Number. The fact that the sum of the sides of the Pythagorean triangle when they have been cubed is nearly equal to the period in question, may well have determined Plato to choose the number 216. It should also be noted that 216 $(= 2^3 \times 3^3)$ is the product of the cubes of the first even (female) and odd (male) number (cf. Macrob. *Somn. Scip.* I 6. 15—16), and cubing makes body: *βάθος γὰρ ἡ σώματος φύσις*, as Aristides says. $216 = 6^3$ is also the area (6) of the Pythagorean triangle cubed: it is likewise 6 × 36, and 36 is not only the sum of the Pythagorean *τετρακτύς* (1, 2, 3, 4, 5, 6, 7, 8), but, as being the number of the *δεκανοί* or *ὡροσκόποι*, was considered to be peculiarly important in generation[1]. But it should be remembered that Plato's object is not so much to determine when children should be born as when they should be begotten. He was firmly convinced that Nature has appointed for man, as she has for many of her other children, a fixed season for begetting good and healthy offspring. In deciding what this season is, he had as little to guide him then as any man who holds similar views has now, or perhaps even less. What he did do was probably something of this kind. Taking the shortest period of gestation as his unit of measurement, viz. 216 days, he divided a woman's life into periods of 216 days, from the day when first she was able to conceive a child. It is this process of calculation, or something like this, which is meant by *λογισμὸς μετ' αἰσθήσεως*. *αἴσθησις* is observation by the archons of the time when each individual girl reaches the age of puberty, and *λογισμός* is the calculation by which they divide her life into periods. There is no reason for holding that the words mean "calculation together with perception of the heavenly bodies," for it would be a waste of labour to deduce from the stars what a perfect organisation within our ideal city could of itself supply, even if Plato admitted practical astrology into his city, of which there is no evidence[2]. During the time when Plato allowed a woman to bear children[3], she would, so far as the claims of maternity or other circumstances would permit her, unite with a bridegroom on the first day of each of these cycles, and possibly on other days within the cycle in which the number 6 predominated (e.g. on every thirtieth or thirty-sixth day). This point will be briefly touched upon again.

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[1] 30 B: cf. 30 D, 32 D, 34 A, 34 B (*εὐδαίμονα θεὸν αὐτὸν ἐγεννήσατο*), 37 C.

[2] 28 B *γέγονεν· ὁρατὸς γὰρ ἁπτός τε ἔστι καὶ σῶμα ἔχων, πάντα δὲ τὰ τοιαῦτα αἰσθητά, τὰ δ' αἰσθητά, δόξῃ περιληπτὰ μετ' αἰσθήσεως, γιγνόμενα καὶ γεννητὰ ἐφάνη.* Whether these words are to be taken in their literal meaning or not, it will be allowed that if Plato can *call* the world *γεννητόν* in the *Timaeus*, he may do so with equal justice in the *Republic*.

[3] *τελειοῖ* is used with the same meaning in the *Theol. Arithm.* p. 58 (Ast): *καλεῖται δὲ αὐτὴ* (sc. *ἐννεάς*) *τελεσφόρος, τελειοῖ δὲ τὰ ἐννεάμηνα.*

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[1] p. 151 (*ed. Meib.*).

[2] p. 16.

[3] Cf. *Theol. Arithm.* p. 40 (Ast): *ἐπεὶ δὲ ὁ ἀπὸ τοῦ στ' κύβος σιστ' γίνεται, ὁ ἐπὶ ἑπταμήνων γόνιμος χρόνος, συναριθμουμένων ταῖς ἑπτὰ τῶν ἓξ ἡμερῶν, ἐν αἷς ἀφροῦται καὶ διαφύσεις σπέρματος λαμβάνει τὸ σπέρμα.* The first six days were not credited with any great efficacy, as appears from an unpleasant story in the beginning of the Hippocratean treatise *περὶ φύσιος παίδων*. The *αἰτία* mentioned by Aristides is that 6 is the product of the first even (i.e. female) and the first odd (i.e. male) number: $2 \times 3 = 6$. This may or may not have occurred to Plato: it probably did occur, but I think he set no great value on it.

[4] *De die Natali* VII 2, where a number of different views are mentioned: cf. Gellius *Noct. Att.* III 16.

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[1] Compare note on p. 53: and Cantor *Gesch. der Math.* p. 86. See also *Procli partes ined.* (Schoell) p. 32.

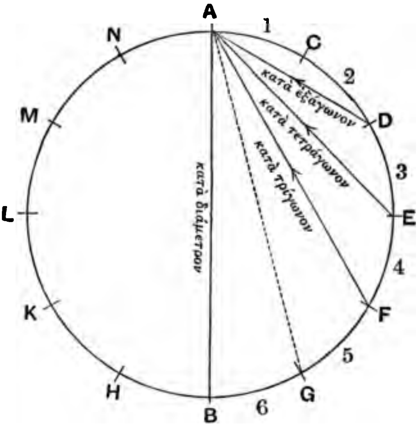
[2] The only use of astrology would be (like the Roman *spectio*) to fortify the archons when they said "Don't," but they are tolerably secure already. The Nuptial Number being *κύριος ἀμεινόνων τε καὶ χειρόνων γενέσεων*, afforded ample scope for the astrological enthusiasm of the Neoplatonists: cf. Schoell's *Procli partes ined.* p. 27, 34 ff. *δεῖ τοίνυν τοὺς τῶν γάμων κυρίους τὸν καιρὸν αὐτῶν θηρᾶν κατὰ μὲν τὰ ἀπλανῆ διά τε τῶν ὡροσκόπων καὶ τῶν τούτοις παρανατελλόντων ἀστέρων τε καὶ δεκανῶν.* Proclus proceeds to illustrate this at length. See also Thompson on the *Phaedrus* 252 E.

[3] This was (in the *Republic*) between the ages of 20 and 40: see v 460 E.

I will now explain what is meant by *αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι, τρεῖς ἀποστάσεις, τέτταρας δὲ ὅρους λαβοῦσαι ὁμοιούντων τε καὶ ἀνομοιούντων καὶ αὐξόντων καὶ φθινόντων.* It is manifest that these words denote in some way the gradual growth of the child within the mother's body.

The *τρεῖς ἀποστάσεις*, which we saw to be 3, 4, and 5, are the third, fourth, and fifth months from conception, the four *ὅροι* being the beginnings of these three months together with the end of the fifth. We know from Censorinus[1] that a peculiar importance was assigned by the Chaldaeans to these three months in the development of the embryo, and as we shall see that Plato is following the Chaldaean reckonings in the next sentence, we may assume that he has them in his mind here also. "Itaque eum" (i.e. the sun), says Censorinus, speaking of the *Chaldaeorum ratio*, "qui stellas ipsas quibus movemur permovet, animam nobis dare qua regamur potentissimumque in nos esse moderarique, quando post conceptionem veniamus in lucem; *sed hoc per tres facere conspectus.*" He then explains the word *conspectus* as follows. The circle of the Zodiac, which is traversed by the sun in the course of a year, is divided into

Fig. ix.



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[1] *De die Natali* VIII.

twelve equal parts (Fig. ix). In each part the sun tarries about a month. *Sed signum quodlibet cum ceteris singulis habet mutuum conspectum,* non tamen uniformem cum omnibus: nam validiores alii, infirmiores alii habentur. At the time of conception the sun must be in some one sign, and in some part of it: the name of this part is the *locus conceptionis:* they are in all 360, 30 in each sign: and they are called by the Greeks *μοῖραι,* eo videlicet quod deas fatales nuncupant Moeras et eae particulae nobis velut fata sunt[1]. Now let us suppose that a child is begotten when the sun is at the point *A* in our figure and let us follow his development. When the sun passes into the next sign, viz. *CD,* locum illum conceptionis aut imbecillo videt *conspectu* aut etiam nec conspicit: nam plures proximantia sibimet zodia invicem se videre omnino negaverunt. This means that in the second month the child makes no considerable advance. But when the sun enters on the third sign and the child consequently on the third month, tunc primum illum locum unde profectus est videre dicitur, sed valde obliquo et invalido lumine; qui conspectus vocatur *κατὰ ἑξάγωνον,* quia sextam partem circuli subtendit (i.e., by joining every alternate sign, a hexagon can be inscribed within the circle). In the third month therefore the child makes at all events some progress. When the sun reaches *E*, and the child thus enters on the fourth month of its development, the sun videt *κατὰ τετράγωνον,* for a similar reason. When the fifth sign and month are entered, *κατὰ τρίγωνον* aspicit: nam tertiam signiferi partem visus ille metitur: *quae duae visiones,* adds Censorinus, *tetragoni et trigoni perquam efficaces incrementum partus multum adminiculant.* The *conspectus* from *G,* when the sixth month begins, *omni caret efficientia:* eius enim linea nullius polygoni efficit latus. But from the seventh sign, quod est contrarium, plenissimus potentissimusque conspectus quosdam iam maturos infantes educit, qui septemmestres appellantur, quia septimo mense nascuntur. Seventh month children are accordingly said *nasci κατὰ διάμετρον*. The Pythagoreans, as we learn from the same authority[1], thought the child was born precisely at *H*, i.e. after 210 days: Plato held that it remained in the womb for 6 days longer, and as 216 = 6 × 36, it is reasonable to suppose that the number of the *δεκανοί* (36) affected his calculations[2].

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[1] Cf. Aristides Quint. p. 152 foll. where all this is worked out in detail, and Stobaeus I § 470 ff. It appears from these writers that each sign was further divided into 3 equal segments, the whole circumference being thus split up into 36 portions of equal length, which were called *δεκανοί* or *ὡροσκόποι* or perhaps *ὡρονόμοι* (for *ὁμονόμοι* in Aristides is probably corrupt), and made use of in casting horoscopes. Sext. Emp. *Adv. Astrolog.* p. 728 ff. (*ed. Bekker* 1842) gives abundant information on these points: cf. August. *de Civ. Dei* v cc. 1—7. See also Sir G. C. Lewis's *Ancient Astronomy* p. 306 ff. and Proclus in Schoell p. 32 referred to above.

We can now see the reason why Plato called cubings "multiplications of root by square." It would seem that he, or those whom he is here following, held that the potency which the child receives at the moment when it enters on the third, fourth, and fifth months respectively results in each case by the end of the month in an increase which is equal to the original potency made solid. The sun, as the giver of *all* increase[3], may well give increase to the embryo, and greater will be the increase, the more fully as the months roll on he flames upon the *μοῖρα* of the child's conception. It is the business of Nature to receive his potencies, which may be measured by 3, 4, and 5 in the three months that make the child, and (*βάθος γὰρ ἡ σώματος φύσις*), making them solid by adding to them two dimensions, create the body of a living child[4].

I have still to explain why the words *ὁμοιούντων τε καὶ ἀνομοιούντων καὶ αὐξόντων καὶ φθινόντων* are said of months. The rolling months 'make like and unlike,' because days and nights, nay, spring and summer and winter[5] are their offspring, ever like themselves and unlike one another. They wax and they wane with the phases of the moon that bore them[1], even as their own children, night and day:

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[1] Ch. XI.

[2] See note on p. 53.

[3] *Rep.* VI 509 B *τὸν ἥλιον τοῖς ὁρωμένοις οὐ μόνον, οἶμαι, τὴν τοῦ ὁρᾶσθαι δύναμιν παρέχειν φήσεις, ἀλλὰ καὶ τὴν γένεσιν καὶ αὔξην καὶ τροφήν.*

[4] Proclus (see Schoell p. 28) appears to give to the words *αὐξήσεις δυνάμεναί τε καὶ δυναστευόμεναι* a further astrological meaning, interpreting *δυνάμεναι* of the stars that prevail, and *δυναστευόμεναι* of the stars which are prevailed against *ἐν ταῖς σπορίμαις ὥραις*. There seems however to be no trace of the astrological meaning of *δύνασθαι* and *δυναστεύεσθαι* as early as Plato.

[5] Aristotle even went so far as to say that the moon—*μήνη* the maker of months—produces a winter and summer in the months as the sun does in the year: see *De Gen. An.* IV 2. 767^{a} 5 *ὁ μὲν γὰρ ἥλιος ἐν ὅλῳ τῷ ἐνιαυτῷ ποιεῖ χειμῶνα καὶ θέρος, ἡ δὲ σελήνη ἐν τῷ μηνί.* Compare Schoell's *Procli partes ined.* p. 29, 1, and Sir G. C. Lewis's *Ancient Astronomy*

> *εἷς ὁ πατήρ, παῖδες δύο καὶ δέκα· τῶν δὲ ἑκάστῳ*
> *κοῦραι ἑξήκοντα διάνδιχα εἶδος ἔχουσαι·*
> *αἳ μὲν λευκαὶ ἔασιν ἰδεῖν, αἳ δ' αὖτε μέλαιναι,*
> *ἀθάναται δέ τ' ἐοῦσαι ἀποφθινύθουσιν ἅπασαι*[2].

I have now to deal with the words *πάντα προσήγορα καὶ ῥητὰ πρὸς ἄλληλα ἀπέφηναν.* It is curious that these words find an echo in a fragment attributed to Philolaus[3] on the virtue of the number 10. The resemblance may be interpreted as an indication either of the spurious or of the genuine character of the fragments of Philolaus, but I am inclined to think that it is slightly in favour of the genuineness of this particular fragment, for it is not unlikely that in a passage so full as this is of Pythagorean influence there should be some verbal indications of the source whence Plato drew something of his inspiration. However this may be, we are told by Censorinus[4] that the Pythagoreans thought the development of the embryo proceeded according to the proportions of the harmony or octave: eos vero numeros, qui in uno quoque partu aliquid adferunt mutationis, dum aut semen in sanguinem aut sanguis in carnem aut caro in hominis figuram convertitur, inter se conlatos rationem habere eam quam voces habent quae in musica *σύμφωνοι* vocantur. How they worked the idea will appear from these words[5]: quorum prior ac minor (sc. partus, i.e. the seven months' child, to which they assigned a life of 210 days within the womb) senario maxime continetur numero. Nam quod ex

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p. 310. Proclus explains *ὁμοιοῦντά τε καὶ ἀνομοιοῦντα* as astrological terms equivalent to *σύμφωνα* and *ἀσύμφωνα*: here again he seems to be ante-dating the superstitions of his own age.

[1] Hesiod (*Works and Days* 771) calls the first half of the month *ἀεξόμενος*, and (*ibid.* 796) the second *φθίνων*.

[2] Cleobulus ap. Stob. I 240. I shall have occasion to refer to this epigram again.

[3] Mullach II p. 4 *νῦν δὲ οὗτος* (sc. *ἀριθμός*) *ποττὰν ψυχὰν ἁρμόζων αἰσθήσει πάντα γνωστὰ καὶ ποτάγορα ἀλλήλοις κατὰ γνώμονος φύσιν ἀπεργάζεται.* It was Tannery who first drew my attention to this remarkable parallel.

[4] Ch. IX *ad fin.* Cf. also Arist. Quint. p. 142, and Plut. *περὶ τῆς ἐν Τιμαίῳ ψυχογονίας* XII 1018 B.

[5] Ch. XI.

semine conceptum est, sex, ut ait (sc. Pythagoras), primis diebus umor est lacteus, deinde proximis octo sanguineus: qui octo cum ad primos sex accesserunt, faciunt primam symphoniam *διὰ τεσσάρων*. (That is, the fourth, which is 8 : 6 or 4 : 3.) Tertio gradu novem dies accedunt iam carnem facientes: hi cum sex illis primis collati sescuplam faciunt rationem et secundam symphoniam *διὰ πέντε*. (That is, the fifth, which is 9 : 6 or 3 : 2.) Tum deinceps sequentibus duodecim diebus fit corpus iam formatum: horum quoque ad eosdem sex collatio tertiam *διὰ πασῶν* reddit symphoniam duplici rationi subiectam. (That is, the octave, which is 12 : 6 or 2 : 1.) Now $6+8+9+12=35$, and as we saw on page 35 that 35 is a *ἁρμονία*, 210 which is 6 × 35 contains 6 *ἁρμονίαι* or octaves. It is impossible not to admire the ingenuity of this, whether it rests on any foundation of fact or not, but the question of interest for us is, How did Plato picture to himself the 'harmony' in the development of the child? So far as I have observed, he has not expressly told us in any of his writings, but it is worthy of remark that the making of Soul in the *Timaeus* likewise proceeds according to the proportions of the octave[1], and that the Universe is constituted, as Plato thought, in the same way[2]. I have little doubt that if he speculated on the subject at all, he followed closely the views of the Pythagoreans, framing the Microcosm, as his manner is, on the lines of the Macrocosm, for although he made[3] the period of gestation 216 (i.e. 6 × 36) rather than, with the Pythagoreans 210 (i.e. 6 × 35), yet 216 is only 210 + 6, and 6 is itself a significant number[4], being the union of the first male and female numbers[5].

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[1] *Tim.* 35 B. In the *Timaeus* 44 D ff. the creation of man's body by the created gods is described. It is reasonable to suppose that the embryo was thought by Plato to develop on the same lines as those on which the gods first made the human body, and a minute study of the *Timaeus* from this point of view might possibly yield some interesting results. In *Tim.* 91 D Plato sums up the development of the embryo in the words *μέχρι περ ἂν—ὡς εἰς ἄρουραν τὴν μήτραν ἀόρατα ὑπὸ σμικρότητος καὶ ἀδιάπλαστα ζῷα κατασπείραντες καὶ πάλιν διακρίναντες μεγάλα ἐντὸς ἐκθρέψωνται καὶ μετὰ τοῦτο εἰς φῶς ἀγαγόντες ζῴων ἀποτελέσωσι γένεσιν.*

[2] *Rep.* x 617.

[3] See above, p. 54.

[4] p. 50 above. We shall see that Plato recognises the period of 210 days and also the longer period of 270 in the sequel.

[5] In Aristides pp. 142 foll. many

Let us now sum up our explanation of the *περίοδος* of the *ἀνθρώπειον γεννητόν*. It is the shortest time within which a child can be perfectly fashioned within the womb, viz. 216 days, and it is during the third, fourth and fifth months after conception that the harmonies of a living organism are fulfilled.

Section 6. *The Diapason: or the words from ὧν ἐπίτριτος πυθμὴν to ἑκατὸν δὲ κύβων τριάδος explained.*

We now approach the diapason—the cycle of the Universe.

I will shew that the words which we are about to discuss give us both the *περίοδος* of the *θεῖον γεννητόν* and the Great Year—the duration of which is one and the same. I will farther establish yet more surely what we have already seen to be probable, that the period of the world's making was conceived by Plato as of the same duration as that of its unmaking; in other words, the Greatest *ἐνιαυτός*, which, as we shall see is 72000 years, falls into two periods, each of 36000 years, in one of which the world is made, as in the other it is unmade. With Plato, as with Heraclitus, the Universe is eternal, not because it always is as we see it now, but because for evermore it is born and dies, each successive body housing its immortality in time: *κόσμον τόνδε τὸν αὐτὸν ἁπάντων οὔτε τις θεῶν οὔτε ἀνθρώπων ἐποίησε, ἀλλ' ἦν αἰεὶ καὶ ἔστι καὶ ἔσται πῦρ ἀείζωον, ἁπτόμενον μέτρα καὶ ἀποσβεννύμενον μέτρα*[1].

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interesting remarks are made on the correspondence of the numbers 210 and 216 and their parts with the phenomena of gestation. Thus in 35 days (the sum of 6, 8, 9 and 12), the child, he says, is formed: and $35 \times 6 = 210$, which is the *περίοδος τῶν ἑπταμήνων ἡμερησία*: the sum of 1, 2, 3, 4 (in which are involved the *ἴσος, διπλασίων, ἡμιόλιος*, and *ἐπίτριτος* ratios) $= 10$, added to 35, yields 45, *καθ' ὃν φασι μορφοῦσθαι τὰ ἐννεάμηνα*: and $45 \times 6 = 270$, which is the number of a nine months' child. It is also important for our purpose when in speaking of the Pythagorean triangle he notices (p. 151) that the sum of the sides 3 and $4 = 7$ (the *περίοδος*, in months, of the *ἑπτάμηνος*), of 4 and $5 = 9$, of 3, 4, and $5 = 12$ (the number of signs in the zodiac), and that (as we have already noted) the sum of the cubes of the sides $= 216$, and $216 + (3 \times 4 \times 5) = 276$ which is about the period of the nine months' child. The Pythagoreans were certainly single-minded and whole-hearted in their devotion to the octave and their favourite triangle. See also Plutarch *περὶ τῆς ἐν Τιμαίῳ ψυχογονίας* XII.

[1] Heracl. *Frag.* 20 (*ed. Bywater*).

It will be convenient to begin by justifying more fully than has hitherto been done the statement that *The period during which the World is in the womb is equal in duration to the period during which the World endures*[1].

We are here concerned primarily with the myth of the *Politicus* (268 E—274 E), the *Timaeus* 29 E to the end (especially 41 A—44 D), and to a less extent with the speech of Aristophanes in the *Symposium* (189 C—193 E).

The myth in the *Politicus* is so important for the right understanding of the περίοδος of the world's creation, that some account of it is absolutely necessary here. I will analyse it as succinctly as I can, quoting the words of the original where they are important for my immediate purpose, which is to prove that, in the *Politicus, the period during which God accompanies* (συμποδηγεῖ καὶ συγκυκλεῖ) *the Universe upon its way is in fact the period during which the Universe is being fashioned in the womb of the Creating Soul*[2].

At one time, says Plato[3], God himself accompanies and helps to wheel the revolving world, at another, when the times are fulfilled, he lets it go, and the Universe begins to roll back again spontaneously, ζῷον ὂν καὶ φρόνησιν εἰληχὸς ἐκ τοῦ συναρμόσαντος κατ' ἀρχάς. The reason for the reversal of the world's motion is that the Universe, since it partakes in body, is not exempt from change, but being more nearly so than is aught else corporeal, τὴν ἀνακύκλησιν εἴληχεν,

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[1] I have no wish to mingle in the wordy war which has raged from the time of Aristotle on the question whether Plato really held the world to be γεννητὸς κατὰ χρόνον, and not merely κατ' ἐπίνοιαν (see Zeller^3 II p. 666 ff.). It does not affect my argument or results in the slightest degree, because those who interpret Plato in this matter allegorically may similarly interpret me: they have sometimes to be so interpreted themselves. Our first business is to interpret aright what Plato *said*: when we have done this (as we have not done yet), it will be time to inquire whether he meant what he said to be literally understood or not. See also page 68, note 2.

[2] In the Orphic verses this identical metaphor is used: see Proclus *in Tim.* 94 B: πάντα γὰρ ἐν Ζηνὸς μεγάλου τάδε δώματι κεῖται καὶ Ζηνὸς δ' ἐνὶ γαστέρι σύν ῥα πεφύκει, and again 95 E τοὔνεκα σὺν τῷ παντὶ Διὸς πάλιν ἐντὸς ἐτύχθη Αἰθέρος εὐρείης ἠδ' οὐρανοῦ ἄγλαον ὕψος κτλ. This whole section in Proclus is most instructive, as well as sections 99—100, whether Plato followed the Orphic doctrines, or they him.

[3] *Polit.* 269 C ff.

ὅτι σμικροτάτην τῆς αὐτοῦ κινήσεως παράλλαξιν. Thus Plato declares that the Universe *τοτὲ μὲν ὑπ' ἄλλης συμποδηγεῖσθαι θείας αἰτίας, τὸ ζῆν πάλιν ἐπικτώμενον καὶ λαμβάνοντα ἀθανασίαν ἐπισκευαστὴν παρὰ τοῦ δημιουργοῦ, τοτὲ δ' ὅταν ἀνεθῇ, δι' ἑαυτοῦ αὐτὸν ἰέναι*[1]. At present the universe is *rolling back* (*ἀνακύκλησις*): in the reign of Cronus it *rolled forward*[2]. The end of the backward is the beginning of the forward movement, and when the forward ends, the backward begins, and the limits of both are marked by destruction among animals and men.

When the backward movement ends, and the forward begins, a few men are left surviving, and these suffer change in sympathy with the whole. The old grow middle-aged and young again till at last they dwindle to a point and disappear: fresh generations are born, not from one another, but from the earth: for those that lie dead within the earth come to life again and in their turn are born old, grow young, and vanish, *ὅσους μὴ θεὸς αὐτῶν εἰς ἄλλην μοῖραν ἐκόμισεν.* In those days, when God ruled the rolling world, and divine shepherds kept their flocks, no creature preyed on any other, nor was there any war nor strife. God was himself the shepherd of the earth-born: they had no *πολιτεῖαι* nor *κτήσεις γυναικῶν καὶ παίδων*, being born by resurrection from the ground. The earth, their mother, fed them with abundant fruits, and they toiled not, neither did they spin. Whether they were happier than we depends entirely on whether they used their manifold advantages as means to help them to attain unto wisdom: tradition says they did not.

When the forward movement ended, and *μεταβολὴν ἔδει γίγνεσθαι καὶ δὴ καὶ τὸ γήϊνον ἤδη πᾶν ἀνήλωτο γένος, πάσας ἑκάστης τῆς ψυχῆς τὰς γενέσεις ἀποδεδωκυίας, ὅσα ἦν ἑκάστῃ προσταχθέν, τοσαῦτα εἰς γῆν σπέρματα πεσούσης*, then the pilot of the Universe *οἷον πηδαλίων οἴακος ἀφέμενος εἰς τὴν αὑτοῦ περιωπὴν ἀπέστη.* Thereupon began the backward movement. At first there was *σεισμός* within the world, attended by destruction among all kinds of living things. The few who survive, ceasing to become young, grow old, while those just born with hoary hair die and return to the earth from whence they have just come. Fresh generations are no longer born from the earth, but even as the world is now left to itself, so also are all its parts, and each race breeds offspring from its kind[1]. After the shock of turning, προελθόντος ἱκανοῦ χρόνου, θορύβων τε καὶ ταραχῆς ἤδη παυόμενος καὶ τῶν σεισμῶν, γαλήνης ἐπιλαβόμενος εἴς τε τὸν εἰωθότα δρόμον τὸν ἑαυτοῦ κατακοσμούμενος ᾔει, ἐπιμέλειαν καὶ κράτος ἔχων αὐτὸς τῶν ἐν αὐτῷ τε καὶ ἑαυτοῦ, τὴν τοῦ δημιουργοῦ καὶ πατρὸς ἀπομνημονεύων διδαχὴν εἰς δύναμιν[2]. Gradually the Universe became less and less accurate in its movements: τούτων δὲ αὐτῷ τὸ σωματοειδὲς τῆς συγκράσεως αἴτιον, τὸ τῆς πάλαι ποτὲ φύσεως ξύντροφον, ὅτι πολλῆς ἦν μετέχον ἀταξίας πρὶν εἰς τὸν νῦν κόσμον ἀφικέσθαι[3]: it is ἡ ἔμπροσθεν ἕξις to which is due ὅσα χαλεπὰ καὶ ἄδικα ἐν οὐρανῷ γίγνεται. As time rolls on, the Chaos of the past makes itself felt more and more till the world is at last in danger of perishing for ever with all that it contains. Thereupon God, careful lest his Universe should vanish εἰς τὸν τῆς ἀνομοιότητος ἄπειρον ὄντα τόπον, takes the helm again, and reversing the motion of the world, ἀθάνατον αὐτὸν καὶ ἀγήρων ἀπεργάζεται[4].

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[1] 270 A.

[2] 271 D, 269 A.

It would be an interesting inquiry to investigate the sources from which Plato drew the materials for this myth. That it embodies many echoes of the early cosmogonies, there can be no doubt. The essence of the whole story is contained in two lines of Hesiod, who, in speaking of the end of the fifth or iron age in which we live, observes

> Ζεὺς δ' ὀλέσει καὶ τοῦτο γένος μερόπων ἀνθρώπων,
> εὖτ' ἂν γεινόμενοι πολιοκρόταφοι τελέθωσιν[5].

Plato would have interpreted this to mean: the present age will end when the age of γηγενεῖς begins. Now as many of Plato's predecessors and notably Empedocles[1] held that the world was in the process of being formed when she put forth the earth-born creatures, it is probable that the 'children of earth' in the *Politicus* are likewise intended as a feature of the making of the world.

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[1] 273 E ff.

[2] 273 A—B.

[3] 273 B.

[4] 273 E.

[5] *Works and Days* 178—179: cf. *Polit.* 273 E, where πολιὰ φύντα of course means "born with grey hair." See also Heraclitus *Frag.* 78 (*ed. Bywater*): the germ of the myth is to be found there also.

That it is the creation of the world which Plato means by the 'forward movement' in this myth can be proved I think, not only by a study of the language taken by itself, but also by comparing the whole myth with the *Timaeus*, and illustrating it by the *Symposium*. Let us first look at the passage by itself. The language of 270 A[2] seems to me conclusive. While the world is being guided by God, it is τὸ ζῆν πάλιν ἐπικτώμενον καὶ λαμβάνοντα ἀθανασίαν ἐπισκευαστήν. The present participle can only mean that the world is acquiring life again, that is, is being recreated, refashioned in the womb of the Divine, while God accompanies it. Once let go[3], the world is described as ζῷον ὂν καὶ φρόνησιν εἰληχὸς ἐκ τοῦ συναρμόσαντος αὐτὸ κατ' ἀρχάς (269 D): and to what can συναρμόσαντος refer if not to the ἁρμονία of creation? Nor is it possible to read the description of the life of the γηγενεῖς without being driven to think of the golden age of Hesiod[4], when our world was being made and the children of the Earth like Gods

ἔζωον ἀκηδέα θυμὸν ἔχοντες
νόσφιν ἄτερ τε πόνων καὶ ὀΐζυος· οὐδέ τι δειλόν
γῆρας ἐπῆν, αἰεὶ δὲ πόδας καὶ χεῖρας ὅμοιοι[5]
τέρποντ' ἐν θαλίῃσι κακῶν ἔκτοσθεν ἁπάντων
θνῇσκον δ' ὡς ὕπνῳ δεδμημένοι· ἐσθλὰ δὲ πάντα
τοῖσιν ἔην· καρπὸν δ' ἔφερε ζείδωρος ἄρουρα
αὐτομάτη πολλόν τε καὶ ἄφθονον.

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[1] Mullach I p. 9 vv. 306—309, 313—316.

[2] See above, p. 59.

[3] I do not think it is by accident that Plato selects the word ἀνεθῇ in 270 A, for ἀνιέναι means sometimes "to put forth offspring" (e.g. *Rep.* III 414 E), but of course no stress can be laid on this.

Works and Days 109 ff.

[5] See *Symp.* 189 E. I strongly suspect that Hesiod also conceived of the golden race as round, and never growing old, but young (οὐδέ τι δειλὸν γῆρας ἐπῆν), and dying like a sleeping child (θνῇσκον δ' ὡς ὕπνῳ δεδμημένοι). A thorough study of the influence of Hesiod and Hesiodic notions on Plato would amply repay the trouble.

Further: the words of 273 B foll. harmonise well with my theory. The world when it is let go fares ill, because of the slumbering elements of chaos, in which it partook before it came into its *present* κόσμος—viz. when it was in the making and God accompanied its movement. In like manner, the creation of the body of the world in the *Timaeus* is nothing but the reducing of chaos into order: see for example 30 A *πᾶν ὅσον ἦν ὁρατὸν παραλαβὼν* (sc. ὁ θεὸς) *οὐχ ἡσυχίαν ἄγον ἀλλὰ κινούμενον πλημμελῶς καὶ ἀτάκτως, εἰς τάξιν αὐτὸ ἤγαγεν ἐκ τῆς ἀταξίας, ἡγησάμενος ἐκεῖνο τούτου πάντως ἄμεινον.* The presence of the Deity coerced the chaos while he made the world, but when the universe has issued from the womb, the trouble reappears.

We have now to compare the myth of the *Politicus* with the making of the world in the *Timaeus*, and the speech of Aristophanes in the *Symposium*.

No one can read the *Politicus* and *Symposium* side by side without being struck by the likeness between these two splendid efforts of the cosmological imagination. The spherical creatures of the Comic Muse are none other than the γηγενεῖς of Philosophy, who ἐγέννων καὶ ἔτικτον οὐκ εἰς ἀλλήλους ἀλλ' εἰς γῆν ὥσπερ οἱ τέττιγες[1]. The slicing of the sphere asunder and the consequent creation of creatures like ourselves is the comedian's description of the moment of ἀνακύκλησις, while the yearning of the two halves to reunite and make ἓν ἐκ δυοῖν symbolises the longing of the iron age for the ancient realm of gold.

More might be made of this, but the *Timaeus* offers us an even more fruitful field of discovery. In the earlier part of that dialogue we have abundant references to the convulsions which attend the changes in the world's movements[2]. It is true that the *Timaeus* is less precise on this point, as for example when the change is called simply παράλλαξις[3], and not, as in the *Politicus*, further defined as ἀνακύκλησις, but this is because Plato's purpose in the earlier part of the *Timaeus* is to describe, not the moment of the world's rebound, but the course of its forward movement—in other words, its generation. The myth of the

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[1] *Symp.* 191 B. Cf. *Polit.* 271 A.

[2] E.g. *Tim.* 21 D, 22 C—D, 23 E.

[3] 22 C. Cf. *Polit.* 269 E.

Politicus is in fact the circle of which the *Timaeus* is one half. While the one sketches in majestic outline the whole progress of the Universe from the moment of its inception to its decline, the other describes in detail how the Macrocosm and Microcosm were constructed. In the half-circle which is common to both we shall find that they agree.

It will be remembered that in the *Timaeus*, after God had created the world, and before mortal bodies were fashioned, he "abode in his own nature": *καὶ ὁ μὲν δὴ ἅπαντα ταῦτα διατάξας ἔμενεν ἐν τῷ ἑαυτοῦ κατὰ τρόπον ἤθει*[1]. What is this but the retiring to his watch-tower? *τότε δὴ τοῦ παντὸς ὁ μὲν κυβερνήτης, οἷον πηδαλίων οἴακος ἀφέμενος, εἰς τὴν αὑτοῦ περιωπὴν ἀπέστη*[2]. The moment for the creation of man has come, and the created gods fulfil their part[3]. This it was no part of Plato's purpose to describe in the *Politicus*, because the *Timaeus* fills the gap. But the younger gods do not create the soul, but only the human body: whence then do they get the soul? God had created it already, and sown it in the earth, and the other instruments of time: *ἔσπειρε τοὺς μὲν εἰς γῆν, τοὺς δ' εἰς σελήνην, τοὺς δ' εἰς τἄλλα ὄργανα χρόνου*[4]. Did the seed lie dormant after it was sown[5]? Here the *Politicus* fills the gap[6]: *ἐπειδὴ γὰρ πάντων τούτων χρόνος ἐτελεώθη καὶ μεταβολὴν ἔδει γίγνεσθαι καὶ δὴ καὶ τὸ γήϊνον ἤδη πᾶν ἀνήλωτο γένος, πάσας ἑκάστης τῆς ψυχῆς τὰς γενέσεις ἀποδεδωκυίας, ὅσα ἦν ἑκάστῃ προσταχθὲν τοσαῦτα εἰς γῆν σπέρματα*[7] *πεσούσης*, then God left the helm. God had told[8] the souls that they must be sown into their allotted instruments of time *before* they were born as men, and He soweth not in vain. Full many a time the seed bore fruit in the children of the earth, and sun, and moon, as their hoary locks grew black and manhood faded into infancy and fell asleep[9].

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[1] 42 E.

[2] *Polit.* 272 E.

[3] 42 E foll.

[4] *Tim.* 42 D.

[5] Plato *παυλίζει*, or Paul *πλατωνίζει* in 1 Cor. 15. 35 ff.: compare Eusebius *Pr. Ev.* XI 28. 17 ff., and August. *Civ. Dei* VIII 9 ff.

[6] *Polit.* 272 D—E.

[7] i.e. sowings.

[8] *Tim.* 41 E.

[9] *θνῇσκον δ' ὡς ὕπνῳ δεδμημένοι* as Hesiod says. See also *Symp.* 190 A *ἦν δὲ διὰ ταῦτα τρία τὰ γένη καὶ τοιαῦτα, ὅτι τὸ μὲν ἄρρεν ἦν τοῦ ἡλίου τὴν ἀρχὴν ἔκγονον, τὸ δὲ θῆλυ τῆς γῆς, τὸ δὲ ἀμφο-*

Fully to discuss all the passages in the *Timaeus* which explain or are explained by the myth of the *Politicus* would lead us too far, but it is necessary to mention a few more points. The well-known *crux* in 36 C—D resolves itself at once, if we take the *Politicus* as I take it. In creating the world God makes the circle of the same to revolve from left to right, that is from west to east, whereas now it revolves from east to west. The simple explanation is that the world was created before the ἀνακύκλησις, which reversed the revolutions of the same like every other revolution human and divine. If I am right in this, it is a signal instance of the necessity for expounding one dialogue of Plato by another[1].

τέρων μετέχον τῆς σελήνης ὅτι καὶ ἡ σελήνη ἀμφοτέρων μετέχει· περιφερῆ δὲ δὴ ἦν καὶ αὐτὰ καὶ ἡ πορεία αὐτῶν διὰ τὸ τοῖς γονεῦσιν ὁμοῖα εἶναι. There is perhaps the merest hint of this *περιφερῆς πορεία* in *Tim.* 44 D—E *ἵν' οὖν μὴ κυλινδούμενον ἐπὶ γῆς ὕψη τε καὶ βάθη παντοδαπὰ ἐχούσης ἀποροῖ κτλ.*

[1] In the *De Caelo* II 2, Aristotle argues that the Universe being *ἔμψυχος* must not only have a right and left of its own, as the Pythagoreans believed, but also an up and down, a front and a back (*ἄνω καὶ κάτω, ἔμπροσθεν καὶ ὄπισθεν*): we may conceive, he says, of the right and left of a sphere, by regarding the sphere as put round something which has a right and left of its own (as for example a human being). Further, Aristotle holds that the right is the side from which movement begins: *δεξιὸν γὰρ ἑκάστου λέγομεν, ὅθεν ἡ ἀρχὴ τῆς κατὰ τόπον κινήσεως*: see also *de Incess. Anim.* ch. 4), and also that the right of the Universe is the east. In order then to explain why the Universe revolves from its own right round again to its own right, he is compelled to assert that the South pole is *τὸ ἄνω*, and the North pole *τὸ κάτω*, that in fact (as we should express it) the Universe stands on its head. If Plato had held that the Universe has a right and left of its own, then this passage of the *Timaeus* might possibly refer to the present movement of the Universe (conceived as standing on its feet) from its own left round again to its own left, but it is certain that he did not (see *Tim.* 62 C ff.), but meant by "motion to the right" simply motion to the right of the spectator. And if in the face of his own definition (*Laws* VI 760 D) of right as "towards the east," Plato could use the words *ἐπὶ δεξιά* here in the sense of "towards the *west*," he is nothing but a framer of riddles, and poor at that. Neither Martin (Vol. II p. 42), nor Böckh (*Über das kosmische System des Platon*, p. 29) offer any explanation worth considering: but Böckh at least recognises the difficulty. The words mean "toward the east," and refer to the motion of the Universe before God left the helm: compare the story about the change in the direction of the sun in the time of Atreus, at the beginning of the myth in the *Politicus* (269 A): *τὸ περὶ τῆς μεταβολῆς δύσεώς τε καὶ ἀνατολῆς ἡλίου καὶ τῶν ἄλλων ἄστρων, ὡς ἄρα ὅθεν μὲν ἀνατέλλει νῦν, εἰς τοῦτον τότε τὸν τόπον ἐδύετο, ἀνέ-*

Again: in the *Politicus* we hear of the convulsions which accompany the commencement of the backward movement of the heavens, when our present cycle came into existence. Now the circle of the same exists not only in the world-soul, but also in the soul which God had already made for human creatures[1]: reverse the motion in the one, and it is reversed in the other. The moment of the reversal in the soul which is to belong to man, is precisely the moment when that soul is enclosed in a human body: and the convulsions which happen at this moment are in the *Timaeus* described in language which recalls the words of the *Politicus*.

The shock of the rebounding Universe is thus described[2]: *ὁ δὲ μεταστρεφόμενος καὶ ξυμβάλλων, ἀρχῆς τε καὶ τελευτῆς ἐναντίαν ὁρμὴν ὁρμηθείς, σεισμὸν πολὺν ἐν ἑαυτῷ ποιῶν, ἄλλην αὖ φθορὰν ζῴων παντοίων ἀπειργάσατο.* Of the souls we read[3]: *εἰς ποταμὸν ἐνδεθεῖσαι πολὺν οὔτ' ἐκράτουν οὔτ' ἐκρατοῦντο, βίᾳ δ' ἐφέροντο καὶ ἔφερον*: sensations *ἐν τῷ παρόντι πλείστην καὶ μεγίστην παρεχόμεναι κίνησιν, μετὰ τοῦ ῥέοντος ἐνδελεχῶς ὀχετοῦ κινοῦσαι καὶ σφόδρα σείουσαι τὰς τῆς ψυχῆς περιόδους, τὴν μὲν ταὐτοῦ παντάπασιν ἐπέδησαν ἐναντία αὐτῇ ῥέουσαι καὶ ἐπέσχον ἄρχουσαν καὶ ἰοῦσαν, τὴν δ' αὖ θατέρου διέσεισαν*—(*the revolution of the same must needs be checked before it will turn back*). While the commotion lasts, *ταὐτόν τῳ καὶ θάτερόν του τἀναντία τῶν ἀληθῶν προσαγορεύουσαι ψευδεῖς καὶ ἀνόητοι γεγόνασιν* (sc. *αἱ περιφοραί*)[4], and the revolutions think themselves victorious

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τελλε δ' ἐκ τοῦ ἐναντίου, τότε δὲ δὴ μαρτυρήσας ἄρα ὁ θεὸς Ἀτρεῖ μετέβαλεν αὐτὸ ἐπὶ τὸ νῦν σχῆμα. In the *Electra* 726 ff. (quoted by Campbell) Euripides alludes to the same story in a way which shews that it was interpreted by some as the mythical expression of an actual permanent change in the movement of the heavens: see also *Orestes* 1101 ff. *ὅθεν ἔρις τό τε πτερωτὸν ἁλίου μετέβαλεν ἅρμα—ἑπταπόρου τε δρόμημα Πελειάδος εἰς ὁδὸν ἄλλαν Ζεὺς μεταβάλλει*, and compare Hdt. II 142, and Sir G. C. Lewis's *Ancient Astronomy*, pp. 69, 133. The airy way in which the myth of the *Politicus* is so frequently said to be "not serious" (see Zeller^3 II 1, pp. 668 and 685), before even an attempt has been made to interpret it, is unworthy of modern scholarship: the ancients were more wise, and some of them (to judge from Proclus *in Tim.* 88 D ff.) appear to have taken the right view.

[1] *Tim.* 41 D ff.: cf. 34 C ff.

[2] *Polit.* 273 A.

[3] *Tim.* 43 A ff.

[4] 44 A.

when they are beaten (κρατούμεναι κρατεῖν δοκοῦσι). This is why a soul ἄνους γίγνεται τὸ πρῶτον, when it is imprisoned in a mortal body.

Now observe what happens when the waves abate. The Universe, says Plato[1], προελθόντος ἱκανοῦ χρόνου, θορύβων τε καὶ ταραχῆς ἤδη παυόμενος καὶ τῶν σεισμῶν, γαλήνης ἐπιλαβόμενος εἴς τε τὸν εἰωθότα δρόμον τὸν ἑαυτοῦ κατακοσμούμενος ᾔει, i.e. the Universe begins to go *back* the way it came. Of the soul in man it is said: ὅταν δὲ τὸ τῆς αὔξης καὶ τροφῆς ἔλαττον ἐπίῃ ῥεῦμα, πάλιν δὲ αἱ περίοδοι λαμβανόμεναι γαλήνης τὴν ἑαυτῶν ὁδὸν ἴωσι καὶ καθιστῶνται μᾶλλον ἐπιόντος τοῦ χρόνου, τότε ἤδη πρὸς τὸ κατὰ φύσιν ἰόντων σχῆμα ἑκάστων τῶν κύκλων αἱ περιφοραὶ κατευθυνόμεναι, τό τε θάτερον καὶ τὸ ταὐτὸν προσαγορεύουσαι κατ' ὀρθόν, ἔμφρονα τὸν ἔχοντα αὐτὰς γιγνόμενον ἀποτελοῦσιν[2]: when the 'periods' becoming calm begin to *go back the way they came*, then the revolutions of the respective circles being forced into the *form* (not the reality) of that which goes its natural way, straightly name the Other and the Same and put their possessor on the road to reason[3].

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[1] *Polit.* 273 A.

[2] *Tim.* 44 B.

[3] The parallel with the *Politicus* seems to me to make it probable that πάλιν means 'backwards.' Ast is perfectly right in saying that πάλιν in Plato is "*retro* (cum vv. eundi et ducendi est *redire, reducere*)"; and for an "again," in which there is nothing of "backward," Plato generally uses αὖθις. But some may think that πάλιν goes with λαμβανόμεναι, as I think Archer-Hind must have taken it, though he does not translate the word: "and the revolutions calming down go their way and become settled as time goes on." I do not think this is right: but *esto*. If it is *while they are getting* calm a second time that the periods go their way, when did they get calm a first time? There is no possible answer which does not bring in the theory of the *Politicus*; for the emphatic position of πάλιν seems to exclude the possibility of connecting it only with γαλήνης in the sense of "becoming calm again" sc. just as they were calm before the shock. But even if πάλιν did mean "again" and not "backwards," my argument would not be affected: for the words of the *Timaeus* clearly denote the same motion as the words in the *Politicus*, that is, the backward movement. The emphasis on σχῆμα, the carefully selected expression τό τε θάτερον καὶ τὸ ταὐτὸν προσαγορεύουσαι κατ' ὀρθόν, which by no means implies that the soul's circles *themselves* revolve according to nature, only confirm my view. I know that Archer-Hind's translation "the orbits are reduced to the form that belongs to the several circles in their natural motion" differs *toto caelo*

The subsequent history of the Universe is parallel to that of man, but there is a difference. The Universe goes from good to bad, and from bad to worse: so therefore does the *race* of man. This is the *αἴτιον* of the degeneration of the ideal state—*φησὶ γὰρ αἴτιον εἶναι τὸ μὴ μένειν μηθὲν ἀλλ' ἔν τινι περιόδῳ μεταβάλλειν*[1]. Be our archons never so perfect, the ageing world will make their state decay. But, as for the individual, it rests with him, or rather with his educators, what his fate shall be: *ἂν μὲν οὖν δὴ καὶ ξυνεπιλαμβάνηταί τις ὀρθὴ τροφὴ παιδεύσεως, ὁλόκληρος ὑγιής τε παντελῶς, τὴν μεγίστην ἀποφυγὼν νόσον, γίγνεται, καταμελήσας δέ, χωλὴν τοῦ βίου διαπορευθεὶς ζωήν, ἀτελὴς καὶ ἀνόητος εἰς Ἅιδου πάλιν ἔρχεται*[2]. Vain though the aspiration be, while he is yet alive, let him aspire *τὰς περὶ τὴν γένεσιν ἐν τῇ κεφαλῇ διεφθαρμένας ἡμῶν περιόδους ἐξορθοῦντα διὰ τὸ καταμανθάνειν τὰς τοῦ παντὸς ἁρμονίας τε καὶ περιφορὰς τῷ κατανοουμένῳ τὸ κατανοοῦν ἐξομοιῶσαι κατὰ τὴν ἀρχαίαν φύσιν*[3]: let him seek to bring the movements of the Same and Other to their original direction. So when the "strong deliv'ress" comes and he knows Death, "the sacred knowledge of Death," whom he has wooed so long, he "returns into his dwelling-place within his kindred star[4]," and in due time, "unless God has set his lines in other places[5]," learns what he had learnt before, that "to grow old in Heaven is to grow young."

Thus it is that the myth in the *Politicus* carries us to the very roots of Plato's philosophy. It is essential to understand it, if we would understand the full meaning of the Number. Aristotle himself connected the two, as I shall now proceed to shew.

In the passage to which I have already frequently referred[6], occur these words[7]: *καὶ διά γε τοῦ χρόνου, δι' ὃν λέγει πάντα*

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from mine, but apart from the fact that this is inconsistent with the *Politicus*, it can only be got out of the Greek, I think, by doing violence to the language.

[1] Arist. *Pol.* v 12. 1316ᵃ 4.

[2] *Tim.* 44 B.

[3] *Tim.* 90 D.

[4] *Tim.* 42 B.

[5] *Polit.* 271 C.

[6] *Pol.* v 12. 1316ᵃ 1 ff.

[7] I take Bekker's text, changing only (with Susemihl) *τε* into *γε*: but I think that *τοῦ χρόνου* should be *τὸν χρόνον* or

μεταβάλλειν, καὶ τὰ μὴ ἅμα ἀρξάμενα γίνεσθαι ἅμα μεταβάλλει, οἷον εἰ τῇ προτέρᾳ ἡμέρᾳ ἐγένετο τῆς τροπῆς, ἅμα ἄρα μεταβάλλει. "And by means of the time, by reason of which he says that all things change, those things also which did not begin to be born at the same time are changed at the same time, for example if a thing has been born *the day before the turning,* it consequently changes at the same time (sc. as something born at a different time from it)." The words are a criticism of the αἴτιον μεταβολῆς assigned by Plato in the Nuptial Number, not of the λύσις or process of dissolution—Plato's account of which Aristotle in fact commends[1]. Now Plato's αἴτιον μεταβολῆς may be regarded as the number which is the measure of our present cycle: this therefore is what is meant by ὁ χρόνος, δι' ὃν λέγει πάντα μεταβάλλειν. Aristotle's objection then amounts to this. In that case a thing born one day before the end of the cycle changes at the same time as a thing born, say, on the day when the cycle began: but if you hold that the περίοδος of the whole is the *cause* of change, it should be fulfilled for each individual thing *before* it can cause that thing to be changed: so that if you call the περίοδος say 36000 years, a thing born in the year 1 will be changed in the year 36000, while another born in 2 will be changed in 36001 and so on. In brief, Aristotle argues that change cannot be explained by the theory that the world will be changed at the end of a certain cycle: for he himself believed in the non-generation of the Universe, and continually attacked Plato for saying that it was generated[2]. The τροπή

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else (more probably) δι' ὃν be changed to δι' οὗ (with Spengel). This however does not affect my argument.

[1] τοῦτο μὲν οὖν αὐτὸ λέγων ἴσως οὐ κακῶς (ἐνδέχεται γὰρ εἶναί τινας οὓς παιδευθῆναι καὶ γενέσθαι σπουδαίους ἄνδρας ἀδύνατον).

[2] *De Caelo* I 10. The words of Aristotle in this passage, whether they were intended to refer to Plato or not, express in a single sentence Plato's statements on the generation of the world (280^{a} 11 ff.) τὸ δ' ἐναλλὰξ συνιστάναι καὶ διαλύειν οὐδὲν ἀλλοιότερον ποιεῖν ἐστὶν ἢ τὸ κατασκευάζειν αὐτὸν ἀίδιον μὲν ἀλλὰ μεταβάλλοντα τὴν μορφήν, ὥσπερ εἴτις ἐκ παιδὸς ἄνδρα γινόμενον καὶ ἐξ ἀνδρὸς παῖδα ὁτὲ μὲν φθείρεσθαι ὁτὲ δ' εἶναι οἴοιτο. Compare *Politicus* 270 E, 273 E. Plato's view is put briefly and emphatically by himself in the *Timaeus* 31 B εἷς ὅδε μονογενὴς οὐρανὸς γεγονώς ἐστί τε καὶ ἔτ' ἔσται i.e. this universe, one and only-begotten, has been born and shall be born hereafter. Compare page 58.

in Aristotle is the *τροπή* of *Politicus* 270 D *ὅταν ἡ τῆς νῦν καθεστηκυίας ἐναντία γίγνηται τροπή*.

We have now shewn that the period during which God accompanies the Universe in the *Politicus* is the period during which the Universe is being fashioned, and thereby justified our identification of this period with the *περίοδος* of the *θεῖον γεννητόν*. Let us now determine the duration of that *περίοδος*. That the forward movement of the Universe was conceived by Plato to last for the same period of time as the backward movement, is certain; for the march of the Universe being regarded as progression and retrogression along one and the same circle, the forward revolution has to traverse the same space as the reverse, and nothing is said of any difference in the speed of the two revolutions[1]. In other words, the creation of the Universe is completed in (so to speak) one revolution of a great circle: in the other it travels on to dissolution. We have thus confirmed the result which we reached on p. 48, where we inferred that the making of the World lasts as long as its unmaking, by interpreting the *τέλειος ἀριθμός* of the *Timaeus* as the same number with the *τέλειος ἀριθμός* of the *Republic*. Each is in a certain sense a Great Year: the sum of the two we may call the Greatest Year—the cycle which sees the Universe begun, completed, and ended. Each is one 'journey round' or *περίοδος*, and it is therefore with perfect justice that Plato uses this word to denote the time which it takes to fashion the Divine Creature.

The *περίοδος* of the *θεῖον γεννητόν* is thus identical with the Great Year. Let us now see how Plato defines its duration in days. Plato builds up the number of the Macrocosm from the number which expresses the gestation of the Microcosm, Man. Taking the sum of the 3 numbers, 3, 4, 5, the sides of the Pythagorean triangle, he multiplies them by the hypotenuse 5, and raises the product to the power denoted by 4, which is the number of the remaining side of the triangle. The *περίοδος* of the *θεῖον γεννητόν* is therefore produced by manipulating the numbers of this magical figure, just like the period of man's gestation, viz. $3^3 + 4^3 + 5^3$. $[(3 + 4 + 5) \times 5]^4$ yields 12,960,000, which is the revolution "measured by the circle of the same[1]" i.e. expressed in days. The life of a child in the womb was also defined in days.

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[1] In 271 A we find *περιφορά* applied to the forward movement: and in 273 E *περίοδος* is said of the backward. The life of the Universe is thus pictured as the revolution of a *single* circle. The plural *περίοδοι* in 269 C and in 270 A does not refer to the cycles of the Great Year, but merely to the revolutions of the world on its own axis.

The number 12,960,000 will assume two harmonies, one of which is 3600^2, the other 4800×2700. What are these two *ἁρμονίαι*? What but the *ἁρμονία* of the World's life, and the *ἁρμονία* of her creation? The latter is sung by the Sirens[2] as their spheres roll onward, its volume swelling till the day when man is born:

> "From harmony, from heavenly harmony
> This universal frame began:
> From harmony to harmony
> Through all the compass of the notes it ran,
> The diapason closing full in man."

The former is the harmony sung while the spheres roll back, waxing feebler and more feeble till God's organ[3] answers to His touch again[4].

The two harmonies will repay a closer study. Let us begin with the first. We know from the *Laws*[5] that Plato counted 360 'days' in the year: the Great Year which is 3600^2 or $(360 \times 10)^2 = 360^2 \times 10^2$ days, is therefore the square of the number of days in the ordinary year multiplied by the square of the Pythagorean perfect number 10. We are now able to express the period in years: it is $\frac{12960000}{360} = 36000$ *years.* Further, 3600^2 is $360^2 \times 100$. Now we know from the *Republic*[1] that Plato reckoned the duration of human life as 100 years, i.e. $100 \times 360 = 36000$ *days.* It follows that the θεῖον γεννητόν lives one year for every day in the life of the ἀνθρώπειον γεννητόν[2].

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[1] *Tim.* 39 D, cf. 39 B.

[2] Compare *Rep.* x 617 B *ἐπὶ δὲ τῶν κύκλων αὐτοῦ ἄνωθεν ἐφ' ἑκάστου βεβηκέναι Σειρῆνα συμπεριφερομένην, φωνὴν μίαν ἱεῖσαν, ἕνα τόνον· ἐκ πασῶν δὲ ὀκτὼ οὐσῶν μίαν ἁρμονίαν ξυμφωνεῖν.*

[3] "Dorylaus scripsit esse mundum organum Dei." Cens. XIII.

[4] Cf. *Polit.* 273 B. This is the full and only adequate meaning of *ἁρμονία* in this passage. It has been shewn that the Nuptial Number as a whole is to be interpreted from the myth in the *Politicus*, and it is only by the forward and backward revolutions that we can explain why the harmony is said to be twofold. The mathematical meaning has been explained on pp. 20, 21.

[5] VI 758 B. The number of Senators in the *Laws* is 360: these are to be divided into 12 sections of 30 each, and each section is to administer the state for one month. The number 60 with its multiples and divisors is the dominant number throughout the *Laws*. 360 'days' is of course only an ideal division of the year: see page 73. Plato recognises (with Philolaus) 364½ days in *Rep.* IX 587 E, where he makes out that the king is 729 times happier than the tyrant, meaning that he is happier every day and every night of his life (cf. 588 A).

In the second harmony the number 100 predominates again. It is "of 100 squares of the rational diameter of 5, minus one each, and of 100 cubes of 3." Now $4800 \times 2700 = (480 \times 10) \times (270 \times 10) = (480 \times 270) \times 10^2$. 270 is the Pythagorean period of gestation for a nine months' child, and 480, which $= 210 + 270$, is the sum of the periods of gestation for children born after seven and after nine months[3]. The period of gestation for the Universe may therefore be denoted by a rectangle whose sides are respectively the longer period and the sum of the two periods in the race of man, after it has been multiplied by the square of the Pythagorean perfect number 10. As the Universe is a 'magnus homo,' and man a 'brevis mundus[4],' it is reasonable that the times which regulate the birth of children should also determine the creation of the Universe.

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[1] x 615 B. Sir James Crichton-Browne in an address on old age (see the *Times* of Oct. 2, 1891), recently said that "he thought it a good working hypothesis that the natural life of man was 100, and that in so far as it fell short of that, it was 'curtailed of fair proportion.' He would especially exhort medical students to start with a resolution that they would not be content with a duration of life shorter than that either for themselves or for their patients."

[2] That it was the custom to follow up discussions *de die natali* by treating of the epochs and duration of human life, may be seen from Cens. XIV and Macrob. *Somn. Scip.* I 6. 65—75.

[3] That Plato has previously reckoned the gestation of a seven months' child at 216 (and therefore, by implication, that of a nine months' child at 276) need not, I think, create a difficulty. He is dealing here with round numbers, solely with a view to arrive at the period of the World's gestation: and Aristides Quintilianus, in the passage where he is alluding to the Platonic number, recognises that 210 days is the period for a seven months' child, explaining the number 216 (the sum of the sides of the triangle after they are cubed), as 210 + the number which denotes marriage, viz. 6. Cf. also *Theolog. Arithm.*, p. 40 (Ast), Cens. XI and Macrob. *Somn. Scip.* I 6. 15—16. Tannery (*Rev. Phil.* I p. 179 note) agrees with me in thinking that in 2700 there is a reference to the nine months' gestation.

[4] Macrob. *Somn. Scip.* II 12. 11. The same expression is used by Philo: see Zeller^3 III 2, p. 397.

It will be seen that I take the first harmony to represent the backward revolution of the Universe, i.e. our present cycle, and the second as expressing the revolution forward, or, in other words, the *περίοδος* of the *θεῖον γεννητόν*—the making of the world.

Section 7. *The number* 36000.

We have thus seen that the Universe endures for 36000 years, which is likewise the period of its incubation. Before we proceed to explain *ἀριθμὸς γεωμετρικός, τοιοῦτον κύριος, ἀμεινόνων τε καὶ χειρόνων γενέσεων*, let us briefly explain the system upon which Plato's reckoning is based.

The number 36000 rests upon the Babylonian sexagesimal system[1], which made 60 the unit, and multiplied it by the factors of itself. This mode of reckoning, which to the present day divides our hour into 60 minutes, and our minute into 60 seconds, was widely spread in very early times, and there are traces of it as far west as Italy. It survived in the Latin use of *sescenti* for an indefinitely large number, and in the period of 6000 years, which was the duration of a dynasty of Etruscan gods. Among the Greeks we find traces of the sexagesimal system as a measure of time as early as Hesiod[2] and Cleobulus[3], and Herodotus expressly tells us that the Greeks borrowed from the Babylonians the division of the day into 12 parts[4]. It is therefore hardly necessary to suppose that Plato borrowed his reckoning directly from the Babylonians, even although, if Berosus may be trusted, 36000 years was actually the duration of a Babylonian cycle[1]. What it is of importance to note is, that the sexagesimal system was very commonly used in calculating long periods of time, from the notion that the year could be divided into 360 equal parts corresponding to the 360 degrees of the circle yearly traversed by the sun[2]. Thus among the Indians 360 years was 'a year of the gods,' 3600 a 'cycle of Bṛihaspati,' 216000 a 'cycle of Prajapati, 4,320,000 an 'age of the gods,' and the 'kalpa' 1000 'ages of the gods' or one 'day of Brahma,' while twice this number, or 8,640,000,000 years was 'a day and a night of Brahma[3].'

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[1] Cf. Hultsch, p. 51. Full information on this system will be found in Brandis, *Das Münz- Mass- und Gewichtswesen in Vorderasien*, pp. 7—21, and in Cantor, *Gesch. der Math.*, pp. 67—94.

[2] *Works and Days* 562, 764 *et al.* I do not of course deny that there must even in Hesiod's time have been some way of making this division correspond with the solar year. See Ideler, *Handbuch der Chronologie* I p. 257 ff., for more evidence on the subject.

[3] If the epigram quoted on p. 55 is genuine.

[4] Hdt. II 109. It would appear that for astronomical purposes the Babylonians divided the day into 60 parts: see Cantor, p. 82.

Let us now see how the number 36000 is connected with other Greek cycles, and with other indications in Plato of the cycle in which he believed.

It does not appear that Anaximander, Anaximenes, Diogenes of Apollonia, or Anaxagoras defined the period during which the world endures, although they held the Universe to be *φθαρτός*[4].

According to Stobaeus[5] the Great Year of Heraclitus was 18000 years, that is, one half of Plato's. Schuster's conjecture[6], that the time from one *ἐκπύρωσις* to another was reckoned by Heraclitus at 36000 years, 18000 being the *ὁδὸς κάτω*, and 18000 the *ὁδὸς ἄνω*, is thoroughly in harmony with the whole tone of Heraclitus' philosophy, and brings Heraclitus very near to Plato[7].

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[1] I take this from Brandis, *Das Münz- etc.*, p. 11. Compare Sir G. C. Lewis's *Ancient Astronomy*, p. 400 ff. The Greek and Egyptian cycle of 36525 years (*ibid.* pp. 282, 389) is reached by a similar calculation, viz. by multiplying the number of days in the year (taken as 365¼) by 100. Lewis's excellent and learned work is a mine of information (see p. 256 ff.) on the part played by the numbers 60 and 360 in the astronomical reckonings of the ancients.

[2] Martin, *Rev. Archéol.* XIII p. 287 ff.

[3] Martin, p. 286. Martin interprets the verses of Hesiod beginning *ἐννέα τοι ζώει γενεὰς λακέρυζα κορώνη ἀνδρῶν ἡβώντων* (Plut. *de def. Or.* 415 c) by taking 400 years as the life of the *κορώνη*, and thus assigns 43,200 (=3600 × 12) years to the phoenix, whose appearance was generally supposed to herald some kind of new era, and 432,000 years to the nymphs. 432,000 years was according to the Chaldaeans the period from the creation to the deluge.

[4] Stob. I 417: cf. Zeller^4 I pp. 213, 230, 247.

[5] I 264. Cens. XVIII 11 assigns 10800 (=30 × 360) years to Heraclitus' cycle.

[6] Zeller^4 I 640 note 2.

[7] The *ὁδὸς κάτω* leads to the formation of the world, and the *ὁδὸς ανω*

The nearest approach to the doctrine of a Great Year in Empedocles is the theory that the wicked δαίμονες are condemned "to wander away from the blessed for thrice ten thousand seasons[1]." Zeller rightly observes that this in no way determines the duration of the world, since the δαίμονες must have lived before the beginning of their wanderings and will live after they are done.

A comparison with the Great Year of Philolaus will not yield any satisfactory result, because, as we know from Censorinus[2], he counted $364\frac{1}{2}$ days in the year. We can only say that had he counted 360 days in the year, then according to the method of reckoning which he employs, his great year would have been $59 \times 360 = 21240$ years, which is $\frac{59}{100}$ of Plato's cycle —and Philolaus (as well as Oenopides) recognised a smaller cycle of 59 years[3].

Aristotle is hostile to the idea of a Great Year, and the only passage which could possibly be otherwise construed is in the first book of the *Meteorologica* 14 p. 352^a 28 ff.[4]; but the most that can be made out of his words is an assertion of the periodical recurrence of partial floods.

Of the later physicists, it is enough to mention the Stoics, whose great year was 365×18000 years, i.e. $\frac{365}{2}$ times the great year of Plato, and the astronomer Ptolemy, whose great cycle, like Plato's, was 36000 years[5].

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to its dissolution. It is the same way, now up, now down. Just so (in the *Politicus*) the περίοδος is the same, now forward, and now backward. The parallel is so exact that one might feel inclined to hold that Plato himself regarded the whole period of the Universe as 36000, falling into two halves: but this will not account for the δύο ἁρμονίαι, 3600^2 and 4800×2700, and lands us in many other difficulties.

[1] Mullach I p. 1: cf. Zeller^4 I p. 706.

[2] Ch. XIX. See also Tannery *Rev. Phil.* XIII p. 213 ff.

[3] Cens. XVIII 8: cf. Stob. I 264.

[4] This explains the remark of Censorinus in Ch. XVIII 11, as Usener has pointed out (*Rhein. Mus.* XXVIII p. 392 ff.).

[5] See Hultsch, p. 57: "Vielleicht knüpfte der grosse Astronom an die oben ermittelte geometrische Zahl Platons an, deren Betrag ihm wohl bekannt sein konnte." In Barocius' *Cosmographia* I p. 6 (*Venetiis*, 1598) I find these words said of the movement of the ninth heavens: qui profecto motus complet unam perfectam revolutionem spatio 36000 annorum iuxta Ptolemaei opinionem; iuxta autem Albategnii, spatio 23760 annorum; iuxta vero Alphonsi, et quorundam aliorum sententiam, 49000 annorum;

It will be seen that Plato's Great Year was arrived at in the same way as that of many of the other Greek philosophers.

Nor is there in the whole compass of his works a single note which is not in unison with it. True it is that in the *Phaedrus*[1] the cycle of transmigrations (including periods for punishment and reward) for a human soul is fixed at 10000 years[2], but as the soul selects a new body only every 1000 years[3], let her clothe herself in body as often as she will, she can do so but 36 times before the cycle closes. And even supposing the philosophic soul, which is winged after three incarnations, or 3000 years[4], chose still to die the death that others may live, for her too there is rest, after 36 lives have been spent in the service of mankind. But these are they who *ἄνευ σωμάτων ζῶσι τὸ παράπαν εἰς τὸν ἔπειτα χρόνον, καὶ εἰς οἰκήσεις ἔτι τούτων καλλίους ἀφικνοῦνται, ἃς οὔτε ῥᾴδιον δηλῶσαι οὔτε ὁ χρόνος ἱκανὸς ἐν τῷ παρόντι*[5].

Section 8. *Conclusion.*

The sum of the two harmonies, counted in days, is $(3600^2) + (4800 \times 2700)$. This is a *γεωμετρικὸς ἀριθμός*[6], for

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quod utique (i.e. whatever its duration is) *temporis spatium vocant magnum Platonicum annum.* This is an interesting confirmation of Hultsch's conjecture, as well as of the present discussion: but a still more convincing proof is furnished by the *Sphaera* of Johannes de Sacro-Bosco (ed. Burgersdicius, 1639) p. 12: orbis nonus centenis quibusque annis juxta Ptolemaeum unum gradum proprio motu conficit, totamque periodum peragit *annis* 36000 (*quod spatium magnus annus appellari solet, aut annus Platonicus*), subiectasque sphaeras una secum circumducit. The work from which this is quoted was a regular text-book of Astronomy till the Copernican theory prevailed over the Ptolemaic: and 36000 years could hardly have come to be called the *annus Platonicus* in a text-book of Ptolemaic Astronomy unless Ptolemy or some of his predecessors or commentators had understood the Nuptial Number, for there is no other passage in Plato which gives the duration of the Great Year.

[1] 248 E ff. I reserve for another occasion a full discussion of the connexion between the cycles of the *Phaedrus* and the Great Year of Plato.

[2] Apparently 11000 according to *Rep.* x 615 A—B.

[3] *Phaedr.* 249 B.

[4] *Phaedr.* 249 A.

[5] *Phaed.* 114 C.

[6] See note 1 on p. 20. It is worth while to remember that the γεωμετρικὴ μεσότης was the symbol of εὐνομία among the Pythagoreans and Platonists: see Proclus *in Tim.* 238 A.

2700 : 3600 :: 3600 : 4800 i.e. 9 : 12 :: 12 : 16. But we have not yet sounded the full depth of meaning in the word *γεωμετρικός*. It is the climax of the whole—a climax not unworthy of the Muses. The whole number, 25,920,000 days or 72000 years, is the measure of the Earth—from the day of her begetting till the day she issued from the womb, and from the hour of her birth till her soul returns to God who gave it. For 36000 years she waxes: through 36000 years she wanes[1].

We have now to explain the words *τοιούτου κύριος, ἀμεινόνων τε καὶ χειρόνων γενέσεων.*

As elsewhere in the *Republic*[2], Plato ascends but to descend. He has risen from the *περίοδος* of the human *γεννητόν* to the cycle of the Universe: from the cycle of the Universe he now descends to that of man. This whole number, measuring the entire life of the World from the moment when it begins, to the moment when it ends, is, in the fullest sense, the final number, of which every other is a part. Of this number Proclus says[3]: *ἐκεῖνος γὰρ καὶ τῶν ἐν τοῖς ἀπλανέσι κινήσεων ἰδίων καὶ τῶν ἐν πᾶσιν ἁπλῶς τοῖς ἐν οὐρανῷ κινουμένοις ἀφανῶς ἢ ἐμφανῶς, θείοις γένεσιν ἢ μετὰ θεούς, καὶ τῶν ἐν τοῖς ὑπὸ*

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[1] *γεωμετρική* in *Gorg.* 508 A has the same twofold meaning: *φασὶ δ' οἱ σοφοί, ὦ Καλλίκλεις, καὶ οὐρανὸν καὶ γῆν καὶ θεοὺς καὶ ἀνθρώπους τὴν κοινωνίαν συνέχειν κτλ. σὺ δέ μοι δοκεῖς οὐ προσέχειν τὸν νοῦν τούτοις, καὶ ταῦτα σοφὸς ὤν, ἀλλὰ λέληθέ σε ὅτι ἡ ἰσότης ἡ γεωμετρικὴ καὶ ἐν θεοῖς καὶ ἐν ἀνθρώποις μέγα δύναται*, i.e. has great power in heaven as well as on earth. Cf. Proclus in Bekker's *Scholia*, p. 83: *τὸ μὲν οὖν παράδειγμα τὸν ἅπαντα αἰῶνά ἐστι, μέτρον δ' ὁ πᾶς αἰών· μέτρον ἄρα καὶ ὁ πᾶς χρόνος. ἀλλ' ὁ μὲν τῆς τοῦ νοητοῦ ζωῆς μέτρον, ὁ δὲ τῆς τοῦδε τοῦ κόσμου ζωῆς, ὁ χρόνος*: and *in Tim.* 270 E *ὁ χρόνος μετρεῖ τὴν ὅλην κίνησιν καὶ τὸ τέλος αὐτῆς ἐπιστρέφει πρὸς τὴν ἀρχήν· διὸ καὶ ὁ ἀριθμὸς ἐπονομάζεται καὶ τέλειος* and *ibid.* 270 F *μετρεῖ δ' οὖν ὁ ὅλος χρόνος ὁ ἐγκόσμιος τὴν μίαν ζωὴν τοῦ παντός* and 271 A—B. The *ἀριθμός* is in fact *τῷ ὄντι γεωμετρικός*: compare *Rep.* VI 511 B *τὰς ὑποθέσεις ποιούμενος οὐκ ἀρχάς, ἀλλὰ τῷ ὄντι ὑποθέσεις* ("ad-sumptions"), *οἷον ἐπιβάσεις τε καὶ ὁρμάς.*

[2] Book VI 511 B—C.

[3] *In Tim.* 271 B. Speaking of the difference between the *τέλειος ἀριθμός* of the *Timaeus*, and the *ἀριθμὸς γεωμετρικός* of the *Republic*, Proclus remarks: *πλὴν προσκείσθω τοῖς εἰρημένοις, ὅτι τοῦτον τὸν τέλειον ἀριθμὸν ἐκείνου τοῦ ἐν Πολιτείᾳ ῥηθέντος, ὃς τὴν παντὸς τοῦ θείου γεννητοῦ περιλαμβάνει περίοδον, οἰητέον διαφέρειν, μερικώτερον ὄντα καὶ μόνων τῶν ὀκτὼ περιόδων, ἀποκαταστατικόν.* Then follow the words quoted in the text above. Proclus expresses himself a little awkwardly, in that at first sight he *seems* to be comparing, not the *ἀριθμὸς γεωμετρικός*, but the *ἀριθμὸς τέλειος* of the *Republic* with the *τέλειος*

σελήνην μακροπορωτέρων ἢ βραχυπορωτέρων περιόδων φορῶν τε καὶ ἀφοριῶν ἐστὶ περιληπτικός· διὸ καὶ τοῦ ἀνθρωπείου γένους τῆς περιόδου κύριός ἐστιν. Seeing therefore that the cycle of the Universe comprehends the cycles of all her children, when she has run her course, so likewise have they. It is in this sense that the number 36000, which measures a single *περίοδος* of the World, is the cause of change: and the remark of Aristotle[1], that the *χρόνος, δι' ὃν λέγει* (sc. Πλάτων) *πάντα μεταβάλλειν,* is no specific cause of the degeneration of the ideal state in particular, is most just. Only for an Ideal City there can be *no* cause of change within itself: nothing but the growing age of Heaven can shake it.

Thus the number 36000 expresses the *ἀνάγκη* that compels our city to decline, but why is the *ἀριθμὸς γεωμετρικός*, 72000 years, *κύριος ἀμεινόνων τε καὶ χειρόνων γενέσεων*? The reason is this. If children are begotten at times which correspond—si parva licet componere magnis—to the times when the Universe was begotten, *γενέσεις* will be *ἀμείνονες*; if at other times, *χείρονες*. Now at what times is the Universe begotten? At the beginning of every 72000 years. How was this number reached? By building it up from the *πυθμήν* of the number 216, which expresses in days the *περίοδος* of a human creature. Here, as throughout his entire philosophy, the disciple of Socrates interprets the Universe from man, but only to turn round and say: "Learn by studying the harmonies and revolutions of the All, *τῷ κατανοουμένῳ τὸ κατανοοῦν ἐξομοιῶσαι κατὰ τὴν ἀρχαίαν*

ἀριθμός of the *Timaeus*. But a closer scrutiny of his words shews that he did not make this mistake. For the *ἀριθμὸς τέλειος* of the *Republic* does not "embrace the period *παντὸς τοῦ θείου γεννητοῦ*," but only *θείου γεννητοῦ*, and Proclus goes on to say that the number of the *Timaeus* is smaller than the number of the *Republic*, meaning thereby the concluding number, *τοῦ ἀνθρωπείου γένους τῆς περιόδου κύριος* (=*τοιούτου κύριος, ἀμεινόνων τε καὶ χειρόνων γενέσεων* in Plato), i.e. the *ἀριθμὸς γεωμετρικός*, which alone is larger—being in fact, as we have seen, exactly double either of the two others. If Proclus had understood *θεῖον γεννητόν* aright—"Divine Creature" and not "Creature created by the Divine," he would have expressed himself more accurately: but even as it is, we can see that it is the *ἀριθμὸς γεωμετρικός* which he interpreted as embracing and fulfilling every other *περίοδος* in heaven and earth.

[1] *Pol. l. c.*

φύσιν[1]." Logically speaking, this is what men call reasoning in a circle: but practically it is not. For when man discovers, or thinks he discovers, that the conditions which regulate his own nature are the laws that rule the whole, he realises, far more surely than before, that the conditions of his own nature are likewise laws, not to be violated without insult to the harmonies of heaven[2]. The categoric imperative "thou shalt" is derived by Plato from the doctrine of man's unity with Nature. To take for example the case which concerns us now, when Plato declares that the Laws of Generation for the Universe are but the Laws of Generation for man writ large, we recognize that we are part and parcel with the Whole, to which in this as in every other thing it is our *duty* to conform. As surely as this goodly Universe is begotten once every 72000 years, and after a period of incubation represented by multiplying the longer period in man into the sum of both the human periods and multiplying the product by the square of ten[3], issues forth a created God, the only-begotten son of the Creator[4], so surely are there times and seasons for begetting man: for what is man but the Universe epitomized[5]? And just as the moment of the World's conception is discovered from its period of incubation, 36000 years, so the right season for begetting children is to be determined from the period of gestation among mankind, 216 days, by means of 'calculation together with perception,' in the way already described[6].

But though our archons are, as far as may be, perfect guardians whose calculation errs not, yet shall our state decay. Though it was founded upon a rock, and for many ages "the rains descended, and the floods came, and the winds blew," and beat upon our city, and it fell not, what of the rock meanwhile? Slowly but surely it was crumbling into sand. Our ideal city degenerated into timocracy, timocracy into oligarchy, oligarchy into democracy, democracy into the "last and worst disease of cities tyranny[1]," because the race of man degenerates as the World grows old and weary of child-bearing:

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[1] *Tim.* 90 D.

[2] Heraclitus *Frag.* 91 *τρέφονται γὰρ πάντες οἱ ἀνθρώπειοι νόμοι ὑπὸ ἑνὸς τοῦ θείου· κρατέει γὰρ τοσοῦτον ὁκόσον ἐθέλει καὶ ἐξαρκέει πᾶσι καὶ περιγίνεται.* It is well expressed by Aristotle in his *Physics* (VIII 2. 252^b 24 ff.): *εἰ δ' ἐν ζῴῳ τοῦτο δυνατὸν γενέσθαι, τί κωλύει τὸ αὐτὸ συμβῆναι καὶ κατὰ τὸ πᾶν; εἰ γὰρ ἐν μικρῷ κόσμῳ γίνεται, καὶ ἐν μεγάλῳ.* See Zeller^3 II 2 p. 488 and III 2 p. 397 and Stein's essay on *Mikro- und Makrokosmos der Stoa* in his *Psychologie der Stoa* I pp. 205—214.

[3] $\{270 \times (210+270)\} \times 10^2$: see above, p. 71.

[4] *Tim.* 31 B.

[5] This is the fundamental idea of Plato's Anthropology, and indeed of all the Greek anthropological inquiries.

[6] On page 51.

> Tristis item vetulae vitis sator atque vietae
> temporis incusat momen caelumque fatigat:
> nec tenet omnia paulatim tabescere et ire
> ad capulum spatio aetatis defessa vetusto[2].

The irresistible strength of *ἀνάγκη* forces the World onward to her dissolution in "much fire[3]," and as she moved farther from her Maker and forgot Him[4], our Perfect City passed away—but not for ever. When the Divine Child dies and is born again, there shall descend from the Heaven where she is stored[5], the perfect Athens[6], ever new and ever old, eternal as the Universe and man, because for ever she is born to die and dies but to be born—῾Ελλάδος *ἔρεισμα, κλειναὶ* ᾿Αθῆναι, *δαιμόνιον πτολίεθρον*[7].

> "A brighter Hellas rears its mountains
> From waves serener far;
> A new Peneus rolls its fountains
> Against the morning-star.
> Where fairer Tempes bloom, there sleep
> Young Cyclads on a sunnier deep.
>
> Another Athens shall arise,
> And to remoter time
> Bequeath, like sunset to the skies,
> The splendour of its prime;
> And leave, if nought so bright may live,
> All Earth can take or Heaven can give."

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[1] *Rep.* VIII 544 C.

[2] Lucretius II 1171—1174.

[3] *Tim.* 22 D.

[4] *Polit.* 273 C.

[5] *Rep.* IX 592 A.

[6] *Tim.* 23 C. Plato's Ideal City is but a patriot's dream of Athens.

[7] Pind. *Frag. Dithyramb.* 4.

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